City of Kelso Railroad Crossing Study

Design Options Summary Report

Provided to:

City of Kelso

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EXECUTIVE SUMMARY

INTRODUCTION

The Washington State High Speed Railroad (HSR) program includes improvements to the Burlington Northern Santa Fe Railroad (BNSF) mainline corridor through the City of Kelso. As part of that program, South Kelso is within the limits of BNSF's proposed $126 million Kelso–Martins Bluff Project, which includes the addition of a third railroad mainline track from the Kelso station to Longview Junction. It is a major railroad improvement with regional benefits for freight and passenger trains and is intended to increase rail capacity. In December 2011, the Federal Railroad Administration (FRA) approved moving the Kelso-Martins Bluff Project to the preliminary design stage. South Pacific Avenue runs parallel to the rail corridor and serves as a major north/south connection in the area that serves city and county citizens with several east/west at-grade roadway crossings over the tracks used by vehicles, bicyclists, and pedestrians.

Anticipating the increase in potential conflicts at these crossings, the City of Kelso (the City) has undertaken a study to review impacts to these transportation connections. The study includes evaluation of the current roadway crossing locations and geometry, and consideration of adjustments to the crossing locations before the HSR plans are finalized. This study summarizes the evaluation of road crossing impacts; options for grade-separation of the crossings; and recommendations to balance safety, mobility, and cost considerations for residents, commuters, and businesses.

The Kelso–Martin's Bluff portion of the HSR program will proceed and is scheduled for completion in 2017. The approximate timeline for the City's grade-separation project could take three to four years, allowing for preliminary engineering design, environmental permitting, bidding, and construction. This does not include the time needed to secure funding.

The study effort represents a significant proactive commitment in addressing the impacts of the HSR program. This study provides a foundation for the City to work with BNSF, Washington State Department of Transportation (WSDOT), Cowlitz County, key stakeholders, and the affected area of the community as the HSR program moves forward. It prioritizes issues, and proposes solutions to challenges such as safety, connectivity, constructability, and cost.

PURPOSE AND NEED

The purpose of the study is to identify a grade-separated railroad crossing location and configuration for South Kelso, which includes reviewing the impacts of eliminating an at-grade crossing at Yew Street, and addressing safety issues related to access to the residential area and property west of the railroad and South Pacific Avenue. The study is needed in order to determine viable options before the planned addition of the third railroad mainline track proposed as part of HSR program.

Land on both sides of South Pacific Avenue and the BNSF tracks lies within both the City of Kelso and Cowlitz County jurisdictions. While the study enables the City to plan appropriate measures to

address existing and future safety issues associated with crossing the railroad corridor for all modes of travel, it also gives the City the opportunity to provide input related to its objectives for safety and connectivity.

The goals and objectives of the City of Kelso Railroad Crossing Study are to:

- Review and build on previous studies for the project area
- Obtain input from key stakeholders
- Identify potential crossing locations and options
- Develop evaluation criteria and evaluate impacts of proposed crossing options
- Develop preliminary design and an opinion of probable costs
- Recommend a viable crossing option

STUDY AREA

The study area is located in the southwestern part of the City of Kelso, and the area is roughly bounded by 13th Street on the east, Hawthorne Street on the north, Hazel Street on the south, and South River Road on the west. Crossing options reviewed for this report are located within this outlined area. Impacts varied by option, and investigations into land use issues, traffic impacts, and potential crossing closures were reviewed. For a map of the study area, please see Figure 1 in Section 3.

CROSSING OPTIONS

In a 2002 Alternatives Study for the Kelso-Martin's Bluff Rail Project, WSDOT considered many options in several locations for providing a safe crossing of the railroad tracks given the addition of a third track in the corridor. Four options were put forth for consideration, all of which would require closure of the Yew Street and Mill Street at-grade crossings and provide a pedestrian underpass at Yew Street.

The City considered two corridors for crossing options as the focus of this study—Hazel Street and Hawthorne Street. The five crossing locations and configurations that were evaluated were:

- Option 1 – Hazel Street crossing under the railroad tracks
- Option 2A – Hazel Street crossing over South Pacific Avenue and the BNSF railroad tracks
- Option 2B – Hazel Street crossing over the railroad tracks
- Option 3 – Hawthorne Street crossing under the railroad tracks
- Option 4 – Hawthorne street crossing over the BNSF railroad tracks

For all of the options, it was assumed that the east/west roadways would include maintaining or building connections to 13th Avenue to the east and to River Road to the west. The goal is to promote connectivity and to minimize the need for out-of-direction travel through neighborhoods to the greatest extent possible in facilitating use of a new grade-separated crossing.

EVALUATION PROCESS

Possible alignments were developed based on the Hazel and Hawthorne corridors and considered over- or underpass configurations. The options were progressively adjusted and evaluated through a series of meetings with City staff and key stakeholders (the Stakeholder Group). The options were evaluated against a set of criteria developed by the project team and reviewed by the Stakeholder Group.

The Stakeholder Group was created to review design concepts from the consultant team, provide community and agency perspective, and offer guidance and feedback throughout the evaluation process. The Stakeholder Group included representatives from:

- City of Kelso Engineering
- City of Kelso Planning
- Cowlitz-Wahkiakum Council of Governments (CWCOG)
- Cowlitz County Engineering
- Washington State Department of Transportation Local Programs
- Washington State Department of Transportation Rail
- Three Rivers Golf Course

Four stakeholder meetings were held from September 2011 to March 2012. The meetings progressively reviewed project options, impacts, prioritization of key issues, development of evaluation criteria, costs, community impacts, rail-related issues and the HSR program, and funding needs and opportunities. Along with the evaluation process, the discussion and feedback at these meetings helped shape the crossing configuration.

Evaluation criteria were developed in response to key issues raised by the Stakeholder Group and City staff, and each criterion was weighted based on prioritization in order to develop scoring. Criteria included neighborhood safety, cost, property impacts, constructability, environmental impacts, redevelopment opportunity, and maintenance. Each of the five options was evaluated and scored (see Table 1, below, for a summary of the five options). General characteristics of the crossing locations and configurations can be described as follows:

HAZEL STREET ALIGNMENT VERSUS HAWTHORNE STREET ALIGNMENT

The Hazel Street alignment generally has good connectivity to the surrounding area, including 13th Avenue. Hazel Street is currently classified as a minor arterial; it has adequate existing width to accommodate this project and provides midpoint access to the area west of the tracks, with the golf course to the south and residences to the north.

The Hawthorne Street alignment is closer to the existing at-grade crossings subject to closure than the Hazel Street alignment and would serve a larger number of the residences east of South Pacific Avenue. There would be potentially significant impacts to residences west of the tracks because of

the narrow existing right-of-way. To connect to 13th Avenue, Hawthorne Street would need to be extended across the CDID #3 slough, and thus would introduce increased traffic to the neighborhood in accomplishing the connectivity.

Undercrossing Versus Overcrossing

Building an undercrossing would be a good visual fit for the surrounding area, since the tracks are already elevated on a berm parallel to South Pacific Avenue. South Pacific Avenue would be lowered at the approaches to the crossing, thus creating simplified vehicular access. However, extensive retaining walls would be needed, which would impact property and complicate construction. To build an undercrossing, train traffic would have to be diverted to a shoofly track, interrupting operations and also impacting property. High groundwater and storm drainage needs would require a permanent pump system to be installed in the low point under the track crossing, and this pump system would increase cost and maintenance, both in the short term and in the long term. From a user perspective, there are typically concerns from the community about an underpass, because it creates a "tunnel feeling" for pedestrians.

Building an overcrossing structure would simplify coordination with rail operations, since a such a structure can be built without interrupting train traffic. A shoofly track would not be required. Given that there is evidence of high groundwater in the area, excessive excavation needed to place the road crossing below grade would not be necessary with an overcrossing. These factors greatly reduce cost and maintenance, and simplify construction. However, an overcrossing will have a substantial visual impact on the immediately adjacent properties. Light pole heights would need to be limited because of the proximity to the Kelso Longview Airport (also known as Southwest Washington Regional Airport).

Proximity to Southwest Washington Regional Airport (SWRA)

The flight path for the SWRA is adjacent to the Hazel Street crossing location. Federal Aviation Administration (FAA) requirements call for a 15-foot clearance for local roadways. Using glide path information in the SWRA Master Plan and applying the more conservative WSDOT vertical clearance requirement of 16.5 feet for vertical obstructions, there is sufficient clearance for the new overcrossing bridge structure. Appendix K contains the flight path diagram for SWRA as it relates to the project area. GIS-level aerial topography was used to develop the design concepts. For final design, detailed design and field survey must be developed to verify and make any adjustments that are required to address clearance. Although the bridge deck meets clearance requirements, the approach may need to be adjusted to increase clearances. Also, it will be necessary to limit streetlight and utility pole heights (if applicable) to provide allowable vertical clearances. This may require the use of a greater number of pedestrian-scale light poles, with closer spacing than typical cobra-head poles, to obtain adequate illumination.

Table 1. Summary of Options

Option	Location / Configuration	Cost	Advantages/Disadvantages	Evaluation Score***
Option 1	Hazel/Under	$51,000,000	• Low traffic impacts in neighborhood east of South Pacific Avenue • Highest cost, expected long-term maintenance crossing under railroad • Construction uncertainties with high groundwater	176
Option 2A*	Hazel/Over	$23,620,000	• Limited traffic impacts in neighborhood east of South Pacific Avenue • Least anticipated cost, constructability, and maintenance	213
Option 2B**	Hazel/Over	$33,250,000	• Limited traffic impacts in neighborhood east of South Pacific Avenue • Significant retaining walls needed would inhibit pedestrian/vehicular circulation; extent of walls may affect neighborhood livability	117
Option 3	Hawthorne/Under	$55,540,000	• Location best situated adjacent with regard to pedestrian concentration • Significant impacts to property west of tracks from road widening • Increased traffic impacts in neighborhood east of South Pacific Avenue with connection to 13th Avenue • Highest cost, expected long-term maintenance crossing under railroad	83
Option 4	Hawthorne/Over	$28,460,000	• Location best situated adjacent with regard to pedestrian concentration • Significant impacts to property west of tracks from road widening • Increased traffic impacts in neighborhood east of South Pacific with connection to 13th Avenue	107

*Option 2A provides access from South Pacific Avenue onto the overcrossing via Douglas Street and an extension of 3rd Avenue (see *Hazel Street: Option 2A Overcrossing* diagram in Section 4).

**Option 2B provides access from South Pacific Avenue directly onto the overcrossing by raising South Pacific Avenue and the approach from Hazel Street above the existing track elevation (see *Hazel Street: Option 2B Overcrossing* diagram in Section 4).

***Maximum possible score = 245.

RECOMMENDED OPTION

Based on the evaluation process, input from the Stakeholder Group, and feedback from the public at the open house, the Hazel Street overcrossing Option 2A is recommended as the preferred option for further development. The Hazel Street overcrossing option appears to provide the optimum balance of safety, costs, constructability, and maintenance.

1. Introduction

With the construction of the High Speed Railroad (HSR) in the Kelso area, it is important for the City of Kelso (the City) to review potential impacts to current crossings, and to consider adjustments before the HSR plans are finalized. The goal for the City is to determine a preferred location for crossing the BNSF railroad line in South Kelso that will provide a safe grade-separated crossing and improved access to the land between the railroad line and the Cowlitz River, and to be proactive in recommending a preferred option before the implementation of the HSR program. The completed railroad crossing study will also provide the basis and justification for securing the funding needed to complete design and construction of the new grade-separated crossing.

Funding to complete this crossing study came from the Federal High Speed Rail program. Initially the money was designated for the construction of an at-grade pedestrian signal near the Allen Street Bridge; however, that project was cancelled and the money was returned to WSDOT. The City has been successful in its efforts to have that money transferred to this study for a grade-separated vehicle crossing.

WSDOT and others have completed previous studies to evaluate crossing options at several locations in the study area. For this study, those previous studies were reviewed, and the information from those studies was used to determine locations for further consideration. The City has determined that two corridors should be the main focus of this study, and the report should evaluate the potential crossing location along the Hazel Street alignment and the potential crossing location along the Hawthorne Street alignment.

Appendix A contains the plan drawings and the cost estimates for the options that were evaluated. Appendices B through K present supporting information on sensitive areas and their regulation, geotechnical recommendations for construction, traffic analysis, comprehensive plan and zoning regulations, design criteria worksheets and scored results of the evaluation process, County and City letters recommending closure of one at-grade crossing, documents from the public involvement program, the location of underground storage tanks, and the flight path diagram for SWRA.

2. Purpose and Need

The purpose of the study is to determine a grade-separated railroad crossing location and configuration, to address safety issues, and to provide improved access to the undeveloped property west of the BNSF mainline tracks and South Pacific Avenue.

The study will determine the appropriate solution in advance of the planned addition of a third railroad mainline track proposed as part of the Washington State HSR program. As part of that program, this area of Kelso is within the limits of BNSF's proposed $126 million Kelso–Martins Bluff Project, which includes the addition of a third railroad mainline from the Kelso station to Longview Junction. The railroad corridor carries both freight and passenger rail traffic, and proposed improvements to the rail corridor are intended primarily to increase capacity of the rail system in

this area. In December 2011, the Federal Railroad Administration (FRA) approved moving the Kelso–Martins Bluff Project to the preliminary design stage. BNSF is planning to have a preliminary layout for the third railroad mainline track completed by the summer of 2012, and the project must be completed by July 2017.

Performing this study enables the City to plan appropriate measures to address existing and future safety issues associated with crossing the railroad corridor for all modes of travel, and it also gives the City the opportunity to provide input to the HSR design related to its objectives for safety and connectivity in this area, and to pursue funding to complete the crossing project.

The goals and objectives of the City of Kelso Railroad Crossing Study are to:

- Review and build on previous studies for the study area,
- Obtain input from key stakeholders,
- Identify potential crossing locations and options,
- Develop evaluation criteria and evaluate impacts of the proposed crossing locations and configurations,
- Develop a preliminary design and opinion of probable cost, and
- Recommend a viable crossing option.

3. Existing Conditions

The study area is located in the southwestern part of the City of Kelso, and the area is outlined in the aerial photo below. The area is roughly bounded by 13th Avenue on the east and at an alignment with Hawthorne Street on the north, Hazel Street on the south, and South River Road on the west. All the crossing options reviewed for this report are contained within this outlined area.

The south Kelso area is separated from the Cowlitz River by the BNSF railroad tracks, and South Pacific Avenue runs parallel to and east of the tracks. The Southwest Washington Regional Airport (SWRA) (also known as Kelso-Longview Airport) is also located in the southern part of the City. Approximately 265 acres of undeveloped or underdeveloped land lies between the river and the tracks (referred to in this report as Southwest Kelso), and includes the Three Rivers Golf Course. Southwest Kelso is accessed by two at-grade crossings, which are located at Yew Street and at Mill Street. Both of the existing crossings have poor sight distance and substandard roadway geometry. Safety issues will likely increase with the introduction of a third track and increased freight and passenger rail traffic.

Figure 1. Study area located in the south Kelso area

Figure 2. South Pacific Avenue at Hazel Street, looking north

The majority of the study area is relatively flat, at approximately elevation 20 feet. An elevated berm adjacent to South Pacific Avenue supports the two BNSF railroad tracks at about elevation 33 feet. The tracks bisect the study area on a northwest to southeast angle. The berm is approximately 27 feet wide at the top. Paved roads and several homes and businesses are located in the vicinity of the potential planned rail crossings. A gravel access road parallels the west side of the railroad tracks south of the study area. The Cowlitz River is approximately 2,150 feet west of the tracks.

Figure 3. Hazel Street corridor west of the track

The Hazel Street corridor west of the tracks is vegetated largely by non-native pasture grasses (tall fescue and bentgrass), and by invasive, exotic weed species (Scots broom and Armenian blackberry). This area also supports numerous black cottonwood trees and saplings. The only water or wetland feature identified within the Hazel Street alignment area west of the tracks was a wetland swale extending north/south, approximately 300 feet east of South River Road. The wetland is centered on an inundated swale approximately 30 feet wide and having apparent wetland conditions about 50 feet beyond the swale along both sides.

Appendix B contains a technical memorandum with a more detailed description of the sensitive areas.

The study area lies within the Cowlitz Drainage Improvement District #3 (CDID 3). Dikes separate the study area from the Cowlitz River. An existing stormwater pump station connection to the Cowlitz River appears to be impassable to fish. Groundwater levels near the study area were measured at depths of 10 to 12 feet when observed in November 2011, and will fluctuate in response to precipitation and the level of the nearby Cowlitz River. Groundwater levels may approach the ground surface during periods of heavy precipitation and/or extended flood levels in the Cowlitz River.

Soils near the surface are alluvium deposits consisting of sand and silt and are underlain by gravel. A large mound of apparent dredge spoils occupies the area immediately west of South Pacific Avenue and the railroad tracks. Geotechnical studies disclosed alluvial sand 100 feet deep at the single boring location and indicated that there is liquefaction potential to an approximate depth of 80 feet during a design-level earthquake. Liquefaction would result in loss of soil strength and significant deformation of the ground surface that would impact structures in the areas, including retaining walls or bridge abutments that would be used in any of the crossing options. Ground improvement will be required to limit deformation and mitigate the risk of potential collapse of portions of the retained embankments and bridge approaches. Because of the risk of liquefaction, foundation support for bridges will likely be provided by deep foundations, such as driven piles, or spread footings in conjunction with ground improvement. (Appendix C, Geotechnical Report, contains the results of the geotechnical survey.)

3.1. Traffic and Crossing Geometry

Two at-grade roadways currently cross the railroad tracks in the study area: Mill Street and Yew Street.

Mill Street, a two-lane roadway, crosses the railroad tracks at a nearly perpendicular angle, with some grade change. The crossing has flashing lights and arms that lower to halt traffic when a train is approaching. It connects a predominantly residential neighborhood to the Three Rivers Mall and Riverside Drive; two Cowlitz River crossings and Exit 39 from I-5 lie to the north.

Yew Street approaches South Pacific Avenue from the east and crosses over the tracks intersecting South River Road. It is a two-lane roadway that crosses the railroad tracks at a skewed angle. A steeper grade occurs as it climbs up the east side railroad embankment, approximately 1,600 feet south of Mill Street. The crossing includes flashing lights and arms that lower to halt traffic when a train is approaching. Yew Street/South River Road serves only the adjacent residential neighborhoods, with no through traffic. Most of the traffic using the Yew Street/South River Road crossing is traveling northbound or southbound on South Pacific Avenue. The awkward intersection configuration can make it difficult for large vehicles traveling northbound on South Pacific Avenue to turn left, climb the embankment, and cross the railroad tracks. The Yew Street/South River Road crossing carries more traffic traveling to and from areas to the south than the Mill Street crossing.

Although the Mill Street crossing is closer to downtown, the Yew Street/South River Road crossing carries the higher traffic volumes on both weekdays and weekend days. The existing daily traffic for the Mill Street crossing ranges from 200 vehicles per day (winter weekend) to 475 vehicles per day (summer weekend). The existing daily traffic for the Yew Street/South River Road crossing ranges from 1,175 vehicles per day (lowest on winter weekends) to 2,440 vehicles per day (highest on summer weekends). Traffic volume data for the existing conditions were collected during the winter of 2011. Traffic volumes were seasonally adjusted to summer conditions to account for greater recreational activity, particularly at the Three Rivers Golf Course. The traffic analysis report can be found in Appendix D.

3.1.1. CRASH ANALYSIS

3.1.1.1. Roadway Crash History

A crash analysis reviewed crash history data from January 1, 2006, through December 31, 2010. Of the 45 reported crashes during that time, fixed object and angle crashes accounted for 58 percent. The crash analysis shows 16 crashes at key locations within the study area. Most of the crashes were property damage only (12). There were no fatalities reported at study area intersections.

The intersection of Mill Street and South Pacific Avenue had the greatest number of reported crashes (6). One-half of these crashes resulted in an injury. Collision types included rear end (2), angle (2), and sideswipe (2).

The Yew Street/South River Road intersection with South Pacific Avenue had four reported property damage only crashes. Collision types included rear end (1), angle (1), and sideswipe (2).

Three property damage only crashes were reported at the South River Road crossing of the railroad tracks. None were related to train activity. Two of the crashes involved a single vehicle collision with a fixed object. The third crash was identified as non-collision and involved two vehicles.

The South River Road intersection with Riverside Drive had three reported crashes; one resulted in an injury. Two of the collisions involved a single vehicle with a fixed object. One collision was categorized as "other" and involved two vehicles and resulted in an injury.

3.1.1.2. Rail Crash History

Crash history along the BNSF alignment was compiled for this study from data provided by the FRA's Web Accident Prediction System, which generates reports of public rail intersections ranked by predicted collisions per year. The Web Accident Prediction System's "accident prediction formula" is based upon basic data about the crossing's physical and operating characteristics as well as five years of crash history. The rankings are not meant to be a standalone list and should be used in conjunction with engineering judgment and further evaluation to identify rail crossing locations that may require additional attention.

There are three crossings of the BNSF railroad tracks within the City of Kelso: Cowlitz Garden (which lies beyond the study area), Mill Street, and Yew Street/South River Road. There were no crashes related to train activity at either the Mill Street crossing or the Yew Street/South River Road crossing during the five-year analysis period (2006 through 2010).

3.2. LAND USE

There are 265 acres of relatively underdeveloped and undeveloped land that occupies a crescent-shaped area formed by South Pacific Avenue and the BNSF tracks to the east, and River Road and the Cowlitz River to the west and south. Figure 4 shows the current jurisdictional boundaries in the study area, with the areas within incorporated City of Kelso shaded pink and areas of unincorporated Cowlitz County shaded light yellow.

Figure 4. Kelso and Unincorporated Cowlitz County in project area

BNSF/Union Pacific Railroad (UPRR) tracks parallel the west side of South Pacific Avenue along the top of an approximately 12-foot-tall berm. Access to the area is limited by the two at-grade crossings of the railroad tracks at Yew and Mill streets.

Figure 5. Milwaukee Place parallels the tracks to the west

The low-lying area west of the tracks has a mix of undeveloped land, a golf course, and single-family residential uses. The northern part of the study area contains mostly older, single-family homes on large lots. The residences take access from one of six roads in this area: Hawthorne Street, Virginia Street, Olive Street, Milwaukee Place, South River Road, and Riverside Drive. During a site reconnaissance, one multifamily residential building was noted, close to Milwaukee Place. There are a few low-intensity industrial and/or commercial service uses along Milwaukee Place. According to the City of Kelso, much of the residential area does not have public water or sewer service, relying instead on private wells and septic systems. A privately

owned golf course occupies the recreation area to the south, where South River Road terminates. The golf course is accessed by South River Road.

Residential, industrial, and commercial development in unincorporated Cowlitz County occupies the area east of South Pacific Avenue. Some industrial uses are found near 13th Avenue in Kelso.

The City of Kelso Land Use Map shows three designations for land uses in the study area: Retail/Office/Commercial, Industrial, and Open. The land roughly north of Olive Street is designated as Retail/Office/Commercial, and the land between Olive Street and the unincorporated area is designated Industrial. South of the unincorporated area there is a strip that is designated Industrial, with the remaining area designated Open.

The City of Kelso zoning map (see Figure 6) designates the area roughly north of an alignment with Hazel Street as RSF-10, a single-family designation that allows 10,000-square-foot minimum lot area per dwelling unit. Land immediately south of the unincorporated boundary is zoned RMF, a residential multifamily zone that allows 1,350-square-foot minimum lot area per dwelling unit.

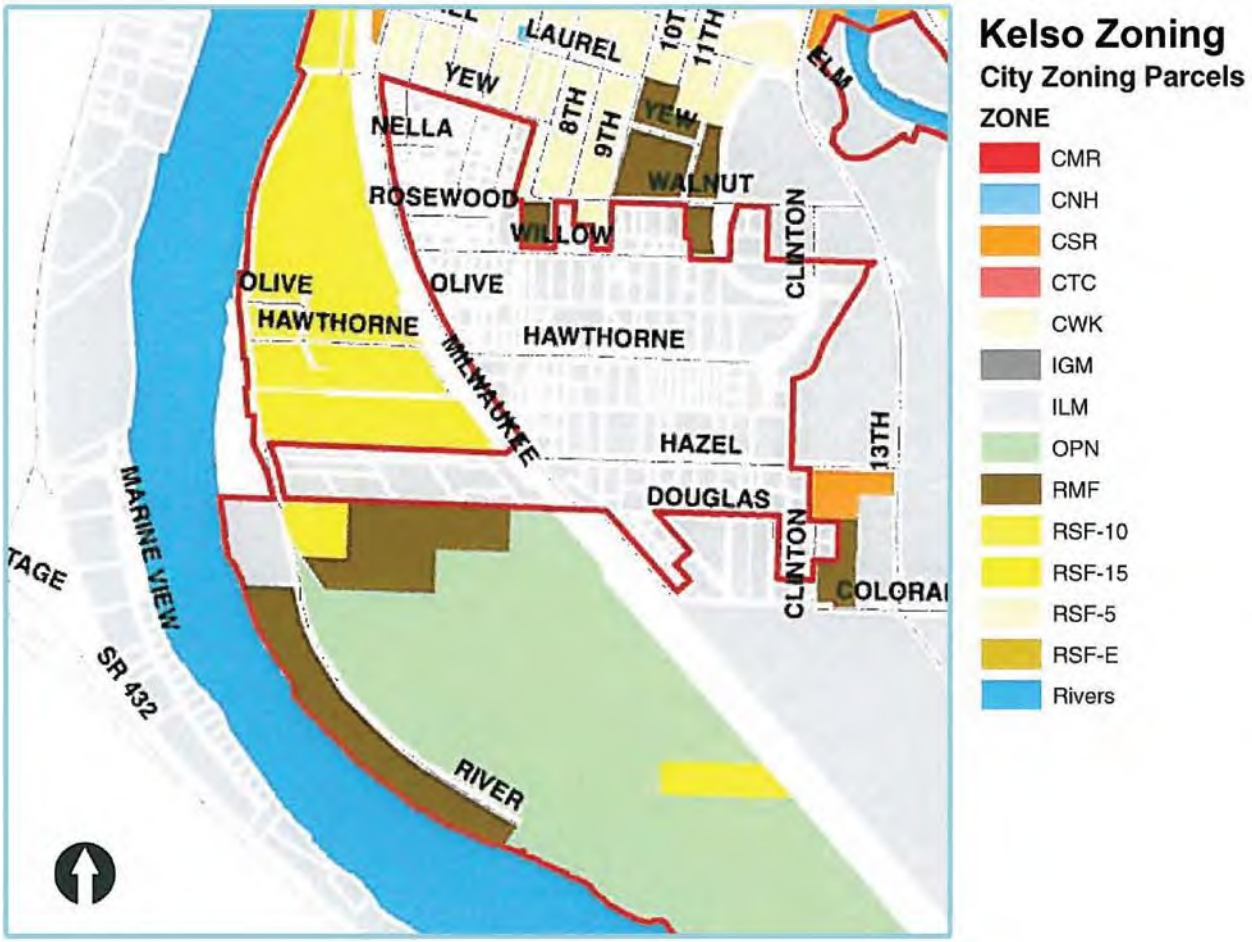


Figure 6. Excerpt from City of Kelso, Washington Zoning Map

There is a pocket of land zoned RSF-10 near South River Road. Most of the area is zoned OPN, open space zone. The purpose of the OPN zone is to ensure that areas characterized by environmental sensitivity are preserved for the most part in their original undisturbed and/or natural state. Areas appropriate for the OPN zoning district are characterized by public and/or private land that is permanently protected from development. There is a pocket of land between South River Road and the Cowlitz River designated ILM, light manufacturing industrial zone. Although there is a strip of land west of South River Road that is zoned RMF (residential multifamily), there does not appear to be any multifamily development currently.

An area of unincorporated Cowlitz County is roughly bounded on the north by an alignment with Hazel Street, on the south by an alignment with Douglas Street west of the BNSF tracks, and on the west by South River Road. County Comprehensive Plan Maps 34-8-2W show the area east of the tracks and south of Willow Street designated/zoned as UR (Urban Residential), except for lots immediately adjacent to South Pacific Avenue, where the designation is C-2 (Urban Commercial). East of the BNSF tracks, the land south of Hazel Street is designated/zoned MH (Heavy Manufacturing), and north of Hazel Street is designated/zoned ML (Light Manufacturing). The unincorporated area between South River Road and the BNSF tracks is designated/zoned AG (Agriculture).

While there is no direct access to the Cowlitz River shoreline from the land east of River Road, the Cowlitz River is a shoreline of the state. Floodplains and wetlands in and near the study area are considered part of the shoreline jurisdiction associated with the Cowlitz River. Such shoreline environments have shoreline designations in the local land use ordinances. The study area is designated "Urban," which allows the most intense use of the shoreline.

3.3. Consistency with Planned Land Uses and Potential for Redevelopment

The railroad crossing project is expected to impact land within both the City and County jurisdictions. Cowlitz County and its cities are not required to plan under the Washington State Growth Management Act (GMA) but are required to implement the requirements of the Shoreline Management Act and the Critical Areas regulations of the GMA. Appendix E contains an evaluation of the consistency of the crossing options with plan policies and objectives. The City of Kelso has initiated an update to its City plan, known as the Kelso "Land Use Plan." The changes proposed as of date of this report do not appear to affect existing policies with respect to arterial or collector transportation facilities in the study area.

The residential lot patterns west of the tracks are irregular, and many exceed the maximum lot size for their zones. There are approximately 65 acres of land within the City of Kelso that are zoned RSF-10 that could eventually redevelop when urban services are provided.

One inconsistency between Kelso's zoning and its Land Use Plan concerns the existing residential uses and zoning, and the planned retail/commercial/office designation on the Land Use Plan for Kelso.

The Land Use Plan for Kelso notes, in Chapter 4, that the area west of the railroad tracks and bordered by the Columbia and Cowlitz rivers is zoned for industrial uses but may not be suitable for such uses given the limitations of wetlands in the area. Future development will be subject to independent permitting processes in areas with wetlands, so the development potential of that land will be addressed on a case-by-case basis.

Although the unincorporated portion west of the tracks is zoned AG, no commercial agricultural use of the properties is evident. The agricultural land in Cowlitz County would need to be annexed and designated for urban land uses before it could be redeveloped for uses other than agriculture. Some existing uses may be nonconforming.

3.4. Federal, State, and Local Environmental Permits

A roadway crossing project in this area would likely need to meet the following federal and state regulatory and permitting requirements: Clean Water Act Section 404, Washington Hydraulic Project Approval (HPA), Federal Endangered Species Act (ESA), Title 14 of the Code of Federal Regulations (CFR) Part 77 (Form 7460-1), Migratory Bird Treaty Act (MBTA), National Environmental Policy Act (NEPA), and the National Historic Preservation Act. See Appendix B for the complete summary of the federal and state permitting requirements.

Figure 7. Wetland ponding north of the Hazel Street alignment

Because of the proximity of the Kelso-Longview Airport, the FAA would likely require the applicant to file a form 7460-1. The form documents the equipment to be used for construction as well as the finished height of the project. Height restrictions depend on where the project falls within the airspace.

Local permits from the City and Cowlitz County (the County) will be required for construction, including Shoreline, Critical Areas, and Flood development permits. Construction of the project would require completion of a State Environmental Policy Act (SEPA) checklist for both jurisdictions in connection with any local permits. A mitigated determination of non-significance would be expected. Appendix E contains a description of the applicable zoning code regulations.

The railroad crossing project would likely require a Shoreline Development Permit. A Shoreline Conditional Use permit would be required because of the stipulation for conditional review for proposed landfills. However, if no fill is proposed in the shoreline area, a Shoreline Substantial Development permit would likely be required instead of a Shoreline Conditional Use Permit.

The railroad crossing project is likely to occur in one or more critical areas or associated buffer areas, such as wetlands or soils having geotechnical issues for construction. Roads are exempt from requiring a permit for development in a critical area only if the construction activity is limited to the existing impact area. None of the City of Kelso railroad crossing options would qualify for this exemption, because they all require work outside existing facilities. If the construction area crosses a critical area, then a permit would be required.

3.5. Wetlands and Threatened and Endangered Species

There is an existing wetland swale on the west side of the tracks that will be considered environmentally sensitive for regulatory purposes. The Kelso Washington/Oregon quadrangle of the National Wetland Inventory depicts this area as a palustrine emergent seasonal wetland. Following on-site and database research, project biologists concluded that only two listed and proposed threatened or endangered species have any possible occurrence or suitable habitat in the vicinity. However, those species are highly unlikely to occur in the study area because of the high levels of human activity and disturbance of suitable habitat. More detail on this topic is presented in the technical memoranda in Appendix B.

3.6. Soil and Groundwater

Based on the geotechnical investigations performed for this project, it was determined that, in the study area, sand beneath the water table will liquefy to a depth of about 80 feet during a design-level earthquake. Liquefaction results in loss of soil strength and significant deformation of the

ground surface at abutments and beneath embankments and retaining walls. Because of the risk of liquefaction, foundation support for bridges will likely be provided by deep foundations, such as driven piles, or spread footings in conjunction with ground improvement.

The planned roadway elevation of the undercrossing options will be below the groundwater level for significant portions of the year. The relatively clean sand encountered in the boring that was conducted for this project has the potential to yield relatively large quantities of water; therefore, a permanent dewatering and pumping station will be needed to lower the groundwater level below the roadway elevation.

Although fine-grained, highly compressible silt soils were not encountered in the boring completed for this project, the experience of the geotechnical experts in the area and a review of available geotechnical information for other nearby sites indicate that such fine-grained, highly compressible silt soils are common in this area. Additional explorations at the planned crossing location are recommended in order to evaluate the site-specific subsurface conditions before construction. If fine-grained soils are encountered, design considerations, such as long-term settlement, may be significant. (See Appendix C, Geotechnical Report, for more details.)

3.7. Environmental Justice Evaluation

A high-level review of the census data for the State of Washington, Cowlitz County, and the study area was completed to identify any potential concerns related to environmental justice and project impacts. Appendix E contains the memorandum that documents this research. The memorandum was completed at an earlier stage of project development, and overestimated the residential impacts associated with Options 1, 2A, and 2B. The statements below have been modified based on current estimates regarding displacements.

The census data review revealed that the study area has a slightly higher percentage of Hispanic population, minority population, and population living below the poverty line than the City of Kelso or Cowlitz County as a whole. However, only the percentage of persons living below the poverty level is greater than that of the state. Although Census Tract (CT) 11 in the study area has a higher percentage of minorities and people below the poverty line than the County does, its demographics are fairly similar to those of the City of Kelso. The study area does not include any known affordable housing projects. However, the census data that generates this conclusion is drawn from a larger area than the immediate study area, one that includes downtown Kelso.

Crossing Options 1, 2A, and 2B, described below, would not displace any residences, but they would displace between two and three businesses. Crossing Options 3 and 4, described below, could displace four or more residences and two to three businesses. It is not known whether the residential displacements would affect a low-income, minority, or Hispanic person(s) or household(s). Therefore, the impacts associated with Options 3 and 4 are higher for individuals than the impacts associated with Options 1, 2A, or 2B. However, even if the households that could be displaced are found to be minority or low-income households, it does not appear that the impacts to a population would be disproportional and adverse, because of the mitigation of impacts that would occur through the right-of-way acquisition process. Residential displacements would be

mitigated through property purchase and provision of relocation assistance. Business displacements would be mitigated with relocation assistance.

4. Project Crossing Options

4.1. Previous Planning Efforts

In a 2002 Alternatives Study for the Kelso–Martins Bluff Project, WSDOT considered many options, at several locations, for providing a safe crossing of the railroad tracks in the event a third track were added to the corridor. After public and agency input, four options were put forth for consideration. All would have required closure of the Yew Street and Mill Street at-grade crossings and provision of a pedestrian underpass at Yew Street. Three options would have created access roads under the berm that carries the railroad tracks—one at Hawthorne Street, one between Hawthorne and Virginia streets, and a third at Hazel Street. South Pacific Avenue would have needed be lowered to meet the undercrossing grades at those locations. The three underpass options would have needed a pump system to handle stormwater runoff and to prevent flooding. A fourth option would have entailed an overpass at Hazel Street, with frontage roads on the east side to provide access to Hazel Street and on the west side to provide access to Milwaukee Place.

In July 2009, OTAK studied conceptual designs for a Hazel Street railroad undercrossing. Two alignment corridors were compared, one running due west from Hazel Street to South River Road and a second beginning at Hazel Road east of the tracks and curving south to meet South Pacific Avenue at a 90-degree angle, then curving on the west side to impact fewer developed parcels. The second alignment corridor was recommended for further study based on its better intersection geometry with South Pacific Avenue, fewer land use impacts, and lower structural costs.

4.2. Design Criteria

Design criteria used for the development of the crossing options include those of the American Association of State Highway and Transportation Officials (AASHTO) (2004), the City of Kelso Engineering Design Manual (2008), and the BNSF and Union Pacific Railroad (UPRR) Joint Manual Guidelines for Railroad Grade Separation (2007).

The determination of the roadway classification is important, because it establishes design speed, typical section widths, intersection spacing, and other important elements of the roadway. The roadway classification used for this project is a minor arterial east of South Pacific Avenue and a minor collector west of South Pacific Avenue. A design exception to the City's standard typical sections will be needed in order to create a tailored typical section for the new roadway corridor to better match the existing roadway widths and future needs of the area. Part of the modification includes providing bicycle and pedestrian connectivity along the corridor, eliminating center turn lanes where appropriate, eliminating parking where appropriate, and reducing overall right-of-way width to accommodate these modifications. A center turn lane will be added at the intersections, when appropriate.

Early in the project development phase, the design criteria for the crossing options were refined to best match existing conditions and to be consistent with the overall goals of the project. The above roadway classification designations are consistent with the current Cowlitz County roadway classification for Hazel Street on the east side of the BNSF tracks and the road system on the west side of the BNSF tracks.

Appendix F contains the Design Criteria Worksheets. The worksheets list the standards and criteria used for this study.

4.3. CROSSING OPTIONS

The Hazel Street and Hawthorne Street corridors were examined using a set of evaluation criteria developed specifically to address the variety of issues and impacts subject to this study. The evaluation criteria, priorities, and follow-up results were developed and discussed with City staff, the Stakeholder Group, and the public. The Hazel Street corridor provided three crossing options for evaluation (Option 1, Option 2A, and Option 2B), and the Hawthorne Street corridor provided two options for evaluation (Option 3 and Option 4), for a total of five options. All options have the same typical section for a standard collector west of the railroad crossing and a modified minor arterial east of the railroad crossing.

The study for this railroad crossing project also reviewed potential closures of the existing Mill and Yew streets at-grade crossings with emergency providers (police and fire). Cowlitz 2 Fire & Rescue preferred, at a minimum, that the Mill Street crossing remain open as a secondary emergency access to the west side of the tracks, and that the Yew Street crossing be closed. (See Appendix G for letters on the at-grade closures from the City of Kelso and Cowlitz County). One the chief concerns was that the area west of the tracks is subject to localized flooding that sometimes hinders access and circulation.

As mentioned previously, the geotechnical investigation disclosed a deep alluvial sand layer combined with a high liquefaction risk. Because of this risk of liquefaction, foundation support for bridges will likely consist of deep foundations, such as driven piles or spread footings in conjunction with ground improvement. Ground improvement will be required to limit deformation and mitigate the risk of potential collapse of portions of the retained embankments and bridge approaches.

Since the City of Kelso and Cowlitz County have jurisdictional land within the study area, it is anticipated that an Intergovernmental Agreement between the agencies will be needed for road design and future maintenance responsibilities. This study did not evaluate specifics of such an agreement, such as annexations or shared costs.

Water quality can be provided for all options with roadside infiltration swales. The area is composed of well-draining sand, and infiltration is the preferred method of stormwater disposal. On the west side of the railroad line, the infiltration swale would run the length of the project on either the north or south side of the roadway, with catch basins approximately every 300 feet. The infiltration swale would perform dual functions of water quality treatment and conveyance. Using the infiltration swales for conveyance will limit the amount of pipe and be more cost-effective. On

the east side of the railroad line, quality could be achieved through an infiltration basin located within purchased right-of-way.

The study does not evaluate specific recommendations regarding public or private utilities to be added to the project. However, it is anticipated that the City of Kelso may consider installation of a pipeline for future use as a water main to serve the area. This study did not review sizing requirements or anticipated future needs for waterlines. It is recommended that future designs review the anticipated needs to evaluate appropriate expansion of a waterline system and review other potential utilities to be carried to the west side of the BNSF tracks.

4.3.1. HAZEL STREET ALIGNMENT

The Hazel Street alignment would construct a new roadway extension from South Pacific Avenue west across the BNSF railroad track and would create a new connection to the existing network that extends from 13th Avenue on the east to River Road on the west. Various design speeds and connectivity issues were reviewed, and the ultimate design criteria used are described in Section 4.2, Design Criteria, above. The Hazel Street alignment generally:

- Has overall good connectivity to the surrounding area and creates a new connection to the existing network that extends to 13th Avenue;
- Has current classification as a minor arterial with adequate existing width to accommodate this project; and
- Provides midpoint access to the area west of the tracks, with the golf course to the south and residences to the north.

4.3.1.1. Option 1: Hazel Street Alignment Undercrossing

Option 1 realigns Hazel Street east of the tracks to cross under the tracks at an approximately 90-degree angle. Hazel Street would continue west to an intersection with South River Road (see Figure 8 on the following page). The roadway would be approximately 20 to 25 feet below the top of the railroad tracks (10 to 15 feet below existing ground).

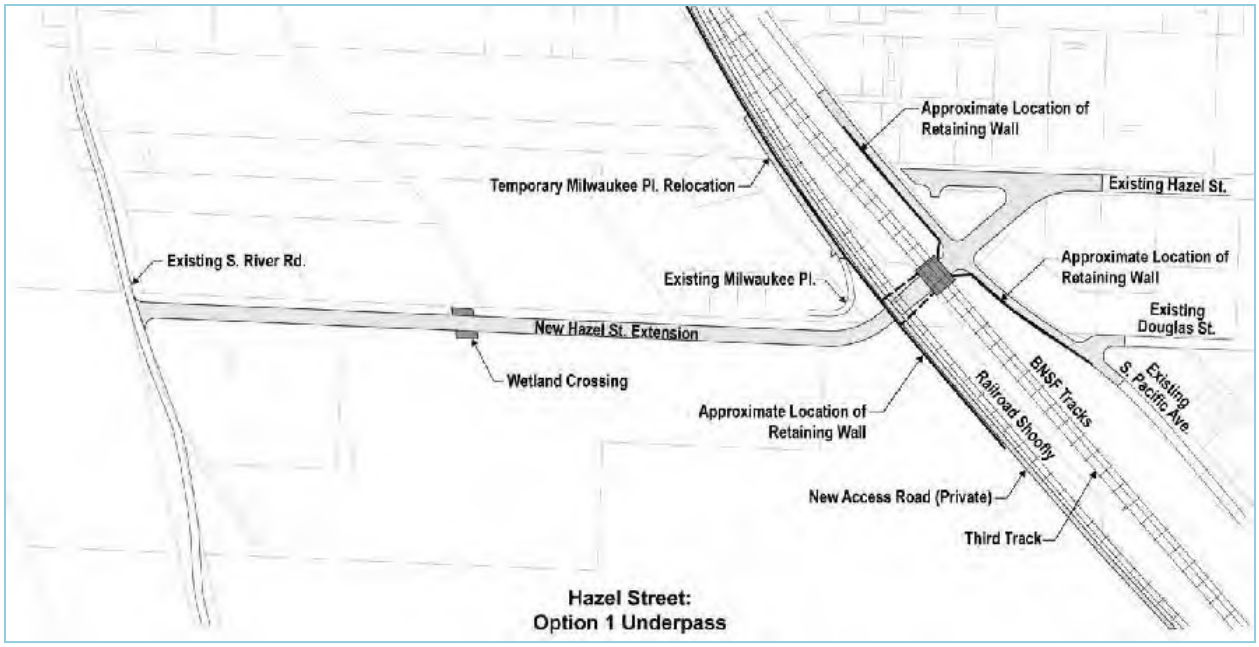


Figure 8. Option 1: Hazel Street Alignment Undercrossing

This option would require lowering the entire intersection of Hazel Street and South Pacific Avenue, and the impacts would extend 500 feet north and south on South Pacific Avenue. It is likely that the underpass structure would be designed and owned by BNSF, and maintenance would need to be addressed that may require a financial commitment to BNSF from the City. The underpass would have less visual impact than an overcrossing; however, this option would require a pump station to drain runoff.

Figure 9. Looking west along Hazel Street alignment near the BNSF tracks

Existing Hazel Street at South Pacific Avenue would be dead-ended. The remnant portion of South Pacific Avenue would require a turnaround. The intersection of Douglas Street and South Pacific Avenue would be reconstructed and lowered to meet the new grade. Access to the undercrossing from the east would be via South Pacific Avenue at the new Hazel Street intersection.

Schematic layouts for single- and double-span bridge options were reviewed. Though a Type, Size, and Location study was not developed for this report, the single-span structure was determined to be the preferred option. The double-span option would require a column in the

center of the roadway, would introduce an obstruction for vehicles, and would likely require offset lanes across the intersection. Further study would be needed to review additional geometric layout issues caused by adding a column in the center of the roadway. The double-span structure would reduce the depth of the structure and thus reduce the amount of cut for the underpass. However, the benefit of the single span's intersection geometry outweighed the depth gain from the double-span design.

Depending on the type of bridge used to support railroad traffic as part of the undercrossing option, the new roadway surface for Hazel Street and South Pacific Avenue would be at about elevation 6 feet, which places the finished grade approximately 10 to 15 feet below existing grades. Based on the results of the geotechnical investigation, the groundwater level would approach the finished grade of the new road surface, and extensive permanent and temporary dewatering systems would be required for the undercrossing option. The relatively clean sand encountered in the geotechnical investigation has the potential to yield relatively large quantities of water; therefore, a permanent dewatering and pumping station will be needed to lower the groundwater level below the roadway elevation.

The system of dewatering wells would need to be operated during the design life of the undercrossing and may likely require a backup power system to maintain stability of the improvements during a flood event. Operation of a long-term dewatering system could affect groundwater levels near the site. If Option 1 is considered further, additional investigation, including a pump test, should be completed to evaluate aquifer properties, potential pumping volumes, and the potential impacts of nearby residential domestic wells.

To maintain rail traffic during construction of the railroad bridge, the rail line would need to be rerouted temporarily on a new portion of track called a "shoo-fly." The shoo-fly would reroute rail traffic to the west side of the proposed underpass. The conceptual shoo-fly layout is based on design speeds required to accommodate Amtrak and freight train traffic along this segment of the BNSF rail line. Constructing the shoofly and rerouting rail traffic would allow work on South Pacific Avenue and the eastern portion of Hazel Street at the same time as the bridge construction, shortening the construction schedule. The shoo-fly would likely need to be built to the same standards that BNSF uses for permanent mainline installations. The alignment of the shoo-fly is controlled by the broadness of the horizontal curves, and adequate distance must be provided between the shoo-fly and the proposed undercrossing in order to allow room for constructing a new undercrossing structure.

The shoo-fly would require a new embankment that would affect Milwaukee Place and access to a number of residential properties. Milwaukee Place would be temporarily relocated west. A portion of the golf course to the south, including several golf course holes, would be temporarily removed from use and later restored. Pre-cast retaining walls that would support the relocated track would limit but not eliminate impacts to the adjacent properties.

At the northwest end of the shoo-fly is an existing turnout or "switch" to storage track that extends to the passenger station. This switch would need to either be taken out of service temporarily or relocated on the shoo-fly alignment near its current location.

The existing mainline has a set of crossovers (switches connecting the two main tracks) and associated signals about 1,500 feet away from the shoo-fly. Constructing the shoo-fly would require that the crossovers be taken out of service during the construction of the bridge, which may not be acceptable to BNSF. The cost of the underpass could be expected to increase by $2 to $4 million if BNSF requires the function of the crossovers to be accommodated nearby or within the shoo-fly.

One item not fully developed for this study was an option to raise the railroad grade to reduce the amount of cut required for construction of the underpass. During a stakeholder meeting, it was suggested that this crossing study should look at minimizing the excavation needed for the underpass by raising the height of the railroad near the new crossing. To raise the tracks approximately 8 feet, the shoo-fly would likely need to be extended 1,500 feet or more to have an acceptable slope for rail traffic and to match existing grades. A wider rail embankment would be required, causing greater permanent impacts on the adjacent roadways and private properties. Elevating the tracks would still require lowering the South Pacific Avenue and Hazel Street intersection approximately 10 feet. Revising the railroad profile grade would require significant additional funds. The benefit of the adjustment would not likely offset the additional cost, because facilities to drain and pump groundwater in the underpass would still be needed.

4.3.1.2. Option 2A: Hazel Street Alignment Overcrossing

Similar to the previous option, Option 2A would revise the Hazel Street alignment just east of the tracks and construct a new portion of the street to cross over the tracks at an approximately 90-degree angle. Hazel Street would continue west to an intersection with South River Road (see Figure 10 below and drawings for Option 2A in Appendix A). BNSF guidelines require the vertical alignment or profile of the roadway to be a minimum 23 feet 4 inches above the top of track, which places the finished grade of the new roadway approximately 40 to 45 feet above existing ground for this option.

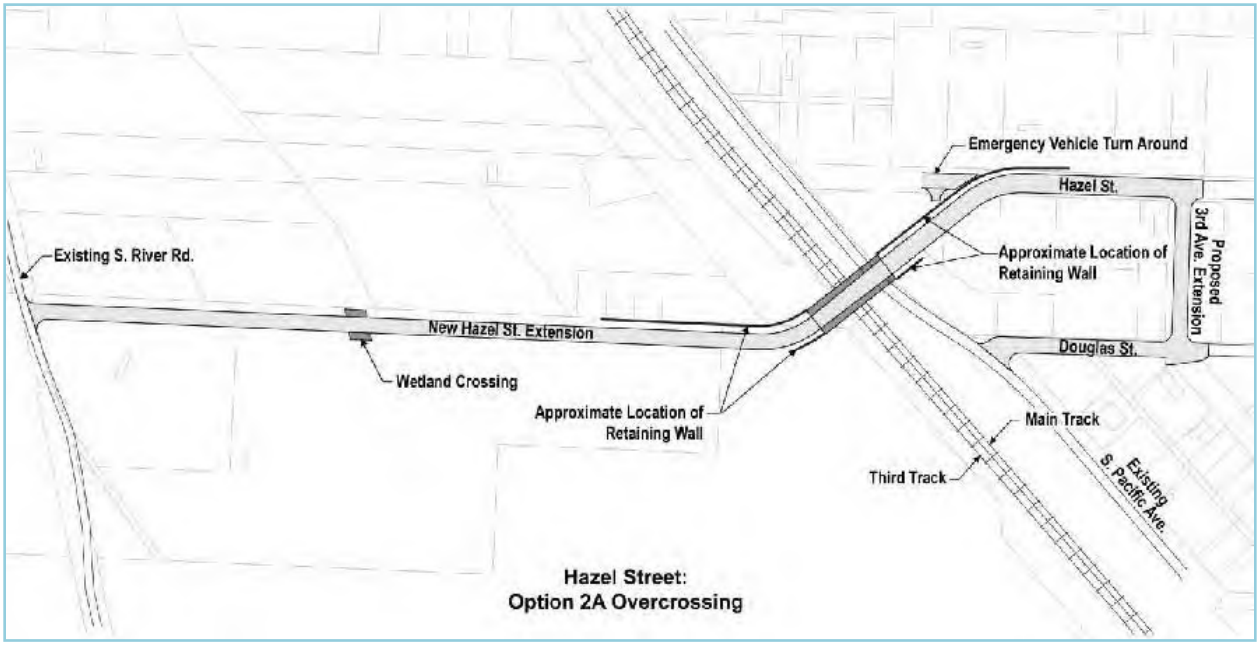


Figure 10. Option 2A: Hazel Street Alignment Overcrossing

The railroad crossing is slightly to the south of the Option 1 alignment, with a longer approach from Hazel Street and a longer structure to cross the tracks. The new crossing would be above the existing Hazel Street, and there would be no direct connection between the original and new Hazel streets west of the new bridge approach. A dead end of Hazel Street at the new bridge approach would provide an emergency vehicle turnaround. West of the tracks, the road would have essentially the same alignment as Option 1 west to South River Road.

As mentioned above, the existing connection between South Pacific Avenue and Hazel Street would be closed. Two alternative connections were reviewed: access from Virginia Street and access from Douglas Street. Ultimately, it was determined that the access from Douglas Street would provide good connectivity between Hazel Street and South Pacific Avenue without having to construct a new street through the neighborhood to the north. The Douglas Street and South Pacific Avenue intersection will need to be improved to accommodate the increased traffic, and Douglas Street would need to be widened to include bike lanes and sidewalks. In addition, an extension or improvement of the 3rd Street alignment between Douglas Street and Hazel Street would be needed to complete the connection, which will require property acquisition from adjacent landowners.

Because of the change in grade approaching the east side of the overcrossing, two additional driveways to businesses on the south side of Hazel Street would need to be closed. Although there may be a reconfigured design that could preserve the accesses, it is assumed for the purposes of conservatively comparing the options that complete acquisitions of the businesses would be required due to the access closures.

The proposed overcrossing accommodates the addition of a third track in the railroad corridor, and the construction would likely have minimal impacts on rail operations. The design meets railroad design standards, which allows for the project to be completed independently of the railroad work and provides the flexibility to move forward with the project as soon as funding is secured. This option would not require the construction of a temporary railroad alignment or shoo-fly; however, construction coordination would be required with BNSF during the life of the project. The structure would likely be owned and maintained by the City of Kelso (as opposed to BNSF under Option 1).

This option would have the most visual impact on nearby residents because of its height compared to surrounding structures. The height of structure at the proposed location does not impact the current flight path from SWRA (also known as Kelso-Longview Airport). However, future expansion of the airport will likely place the lighting on the bridge and potentially other items within the flight path surface (see plan and profiles in Appendix A that show the flight path surface). Continued coordination with the airport representatives is recommended, and the option should be developed to minimize obstructions in the flight path (such as reduced height of illumination poles) as the project progresses.

4.3.1.3. Option 2B: Hazel Street Alignment Overcrossing

Option 2B would have the same alignment over the tracks as Option 2A. The difference is in access to the overcrossing (see Figure 11 on the next page). This option provides access via South Pacific Avenue, which would be raised to meet the new elevation of Hazel Street (see Option 2B profile drawing in Appendix A), whereas Option 2A provides access to Hazel Street via Douglas Street.

Extensive retaining walls on both sides of South Pacific Avenue and Hazel Street would be needed to minimize the direct impact to the properties immediately adjacent. The Douglas Street intersection with South Pacific Avenue would be reconstructed. A westbound connection on Hazel Street would be provided in order to provide access to the properties between the existing Hazel Street and South Pacific Avenue intersection. For discussion purposes, the alignment west of the BNSF tracks for Option 2B is different than under the other options; however, an alignment similar to the one shown for either Option 1 or Option 2A is also possible.

Although the bridge over the BNSF railroad tracks would be shorter under this option than under Option 2A, the overcrossing would still have major visual impacts and significant physical impacts to the immediate neighborhood and traffic circulation pattern.

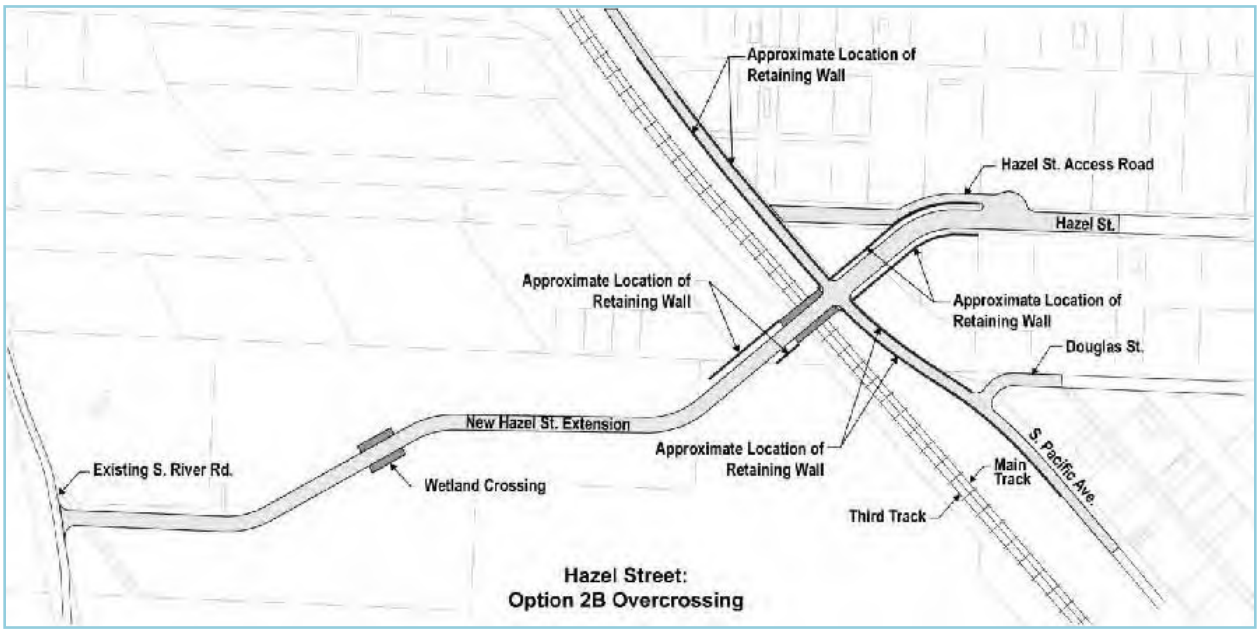


Figure 11. Option 2B: Hazel Street Alignment Overcrossing

4.3.2. HAWTHORNE STREET ALIGNMENT

The Hawthorne Street alignment would construct a new roadway east and west of the tracks. It would extend Hawthorne Street from South Pacific Avenue west across the BNSF railroad track to South River Road, and construct a new roadway east from the existing end of Hawthorne Street to 13th Avenue. This new roadway would cross undeveloped land and create new structures across the CDID #3 slough. A number of design speeds and options for connectivity were reviewed. The final design criteria are described in the Section 4.2, Design Criteria, above. Generally, the Hawthorne Street alignment:

- Is slightly closer to existing crossings than Hazel Street;
- Would need to extend Hawthorne Street across the slough to provide connection to 13th Avenue;
- Would require improvement of existing Hawthorne Street; and

- Would have potentially significant impacts on residential property and housing west of the tracks.

4.3.2.1. Option 3: Hawthorne Street to Virginia Street Undercrossing

Option 3 would construct a new section of Hawthorne Street from 13th Avenue to the existing dead end, revise the horizontal alignment of existing Hawthorne Street immediately east of the tracks, and construct a new section to the southwest under the tracks and west to an intersection with South River Road (see Figure 12 below).

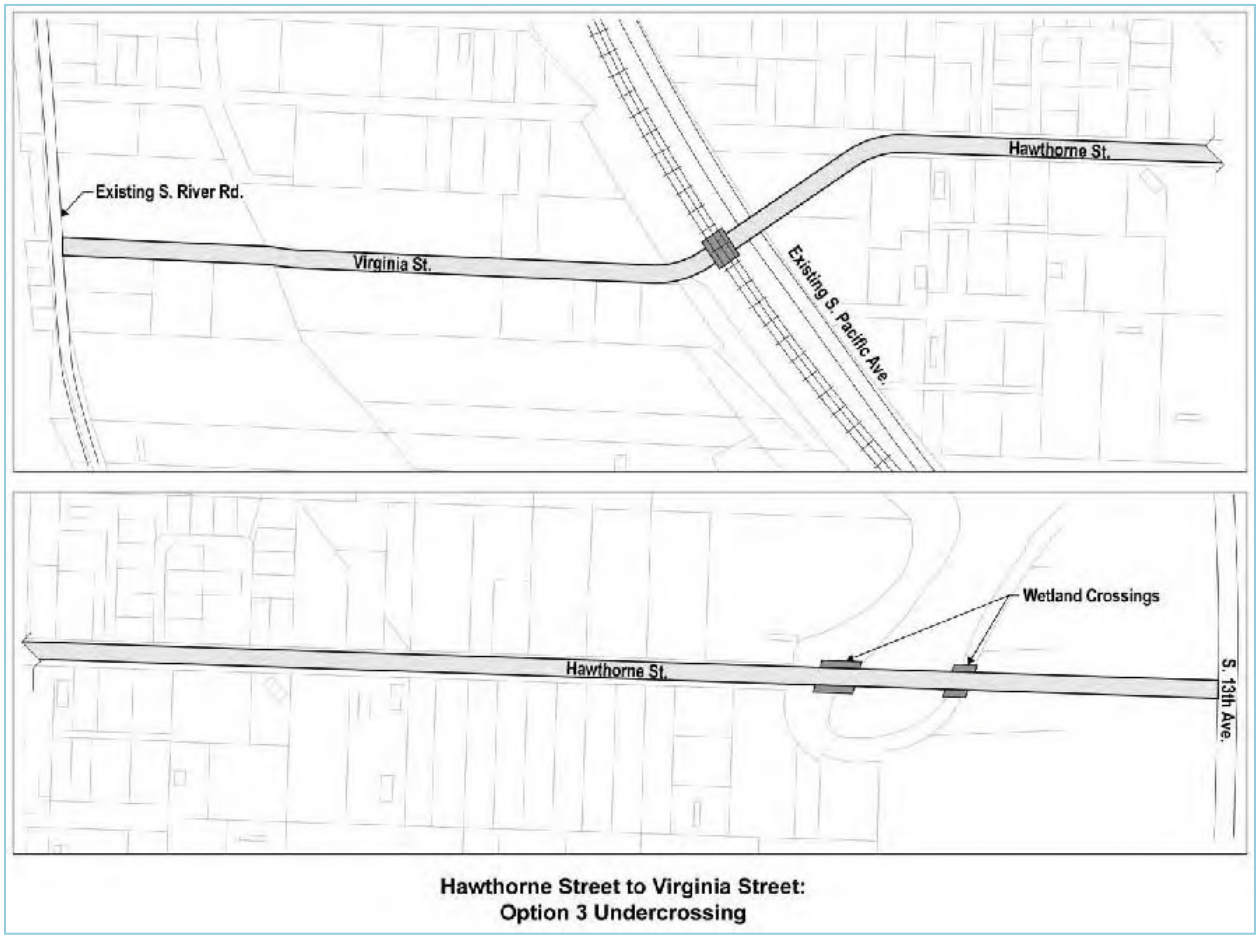


Figure 12. Option 3: Hawthorne Street to Virginia Street Undercrossing

The study of crossing options did not include establishing the vertical geometry of Option 3. Similar to Option 1, the vertical alignment of the roadway would need to be approximately 20 to 25 feet below top of rail, which is assumed to be 10 to 15 feet below existing ground level. Option 3 would lower the entire intersection of Hawthorne Street and South Pacific Avenue and would require a pump system to remove stormwater from the underpass.

Street widening along the existing Hawthorne Street east of the tracks would be included to provide bike lanes and sidewalks, as shown on the typical sections (see Appendix A). The impacts of this street widening were not fully investigated, and the design would need to be advanced in order to fully examine impacts for all the properties along this corridor. It is anticipated that most

properties would be impacted because of the narrow existing right-of-way. Several entire properties would need to be purchased under this option. The extension to the east would require either two new bridges or large culverts to cross the CDID #3 slough approaching 13th Avenue. Additional design would be needed to determine the additional project impacts and size requirements of culverts/bridges and other elements needed to accomplish this option.

4.3.2.2. Option 4: Hawthorne Street to Virginia Street Overcrossing

This option uses the same horizontal alignment as Option 3, but it would cross over the tracks, rather than under (see Figure 13 below).

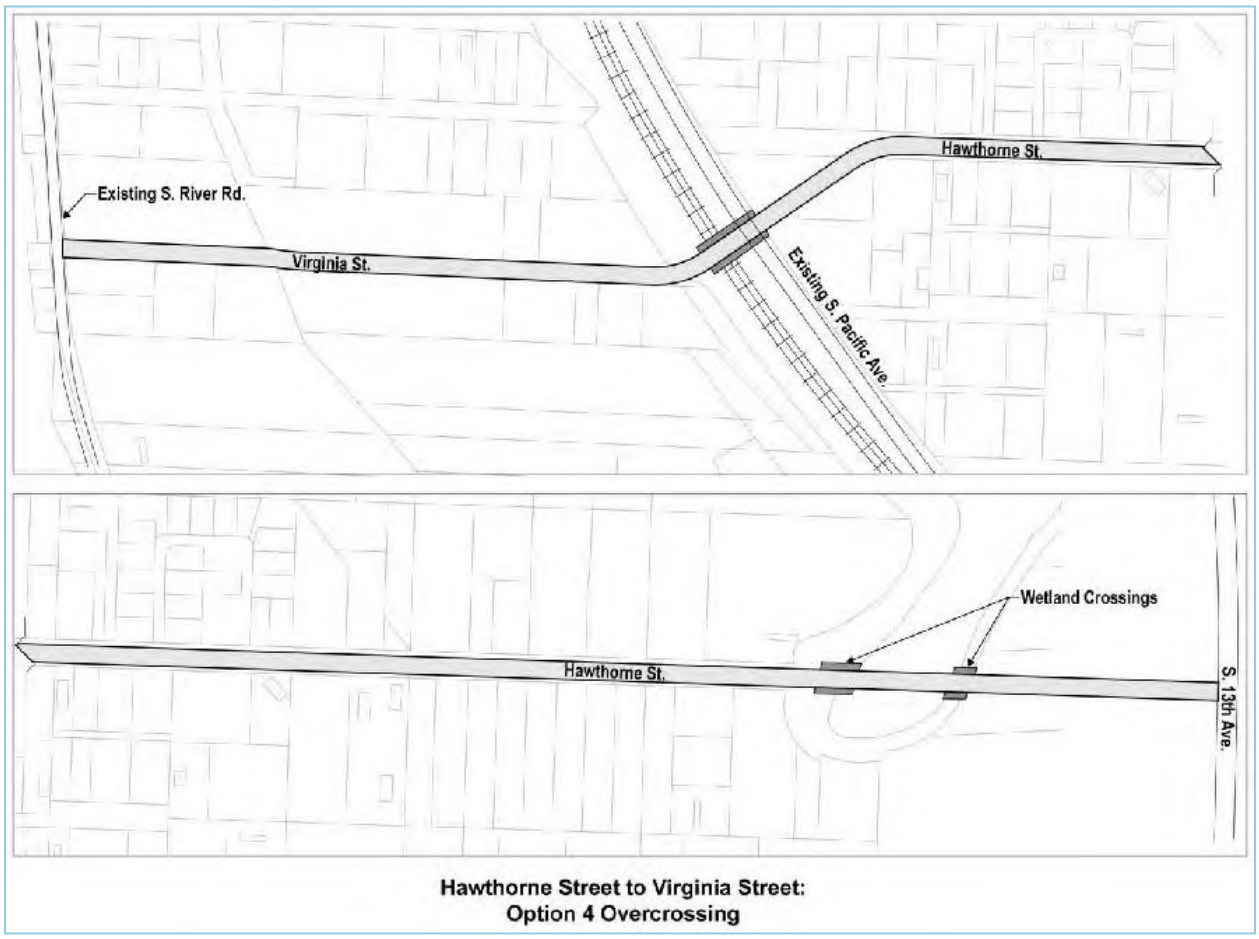


Figure 13. Option 4: Hawthorne Street to Virginia Street Overcrossing

Although the study did not fully investigate impacts from the vertical alignment for Option 4, the profile of the roadway would be a minimum 23 feet 4 inches above the top of track, which likely places the finished grade of the new roadway approximately 40 to 45 feet above the existing ground level, similar to Option 1. The impacts to Hawthorne Street and the surrounding areas from the horizontal geometry would be similar to those described under Option 3. The differences would be the result of longer retaining walls being needed for several hundred feet east and west of the new overcrossing. This option would have similar connectivity issues as Option 2A from South Pacific Avenue to the new crossing. To connect Hawthorne Street to South Pacific Avenue, a new

road would likely need to be constructed via Olive Street or Virginia Street. Additional roadway design in several areas would be needed to investigate completely the impacts and requirements of this option.

5. Traffic Analysis Results

For the purpose of analyzing potential traffic circulation impacts, it has been assumed that the grade-separated crossing proposed by this project would replace at least one of the existing at-grade crossings and that Yew Street would be closed. Mill Street could also be closed to traffic, although this is not desired because of impacts to emergency vehicle services. Scenarios considering both these options were evaluated.

5.1. Traffic Data

5.1.1. Future Traffic Volumes

To evaluate a range of possible growth scenarios, two growth rates were considered for the study area. An annual growth rate of 0.5 percent per year was initially considered as a low-end scenario that would have little redevelopment or growth in the area west of the railroad tracks. A scenario with a higher growth rate of 2.0 percent per year was added to account for redevelopment at higher densities in some of the study area west of the railroad tracks. These growth rates were applied to the estimated 2011 summer weekday traffic volumes. Only weekday volumes were developed for the future condition, because the weekday volumes were consistently higher than the weekend volumes.

5.1.2. Future Traffic with Existing At-Grade Crossings

The projected weekday traffic for each existing at-grade crossing and growth scenario is presented in Table 2.

Table 2. Summary of Future (2035) Volume Estimates with Existing At-Grade Crossings

Railroad Crossing	2035 Weekday Traffic (vehicles/day)	
	0.5% Growth	2% Growth
Mill Street At-Grade	535	765
Yew Street/South River Road At-Grade	2,215	3,160
Total Crossing Volume	**2,750**	**3,925**

5.1.3. Future Traffic with Hazel Street Grade-Separated Crossing

Two at-grade crossing closure scenarios were considered: (1) closure of just the Yew Street crossing and (2) closure of both the Yew Street and Mill Street crossings with emergency vehicle access remaining at Mill Street. The projected weekday traffic for each existing at-grade crossing and growth scenario is presented in Table 3.

Table 3. Summary of Future (2035) Volume Estimates with Hazel Street Grade-Separated Crossing

Railroad Crossing	2035 Weekday Traffic (vehicles/day)			
	0.5% Growth		2% Growth	
	Low Option 1 (Yew Closed)	Low Option 2 (Both Closed)	High Option 1 (Yew Closed)	High Option 2 (Both Closed)
Mill Street At-Grade	980	0	1,395	0
Yew Street At-Grade	0	0	0	0
Hazel Street Grade-Separated	1,770	2,750	2,525	3,920

If only the Yew Street crossing were to be closed, the estimated weekday volumes across the new Hazel Street crossing are 1,770 vehicles for the low-growth scenario and 2,525 vehicles for the high-growth scenario. The closing of both the Yew Street and Mill Street crossings would result in average daily traffic (ADT) volumes across the new Hazel Street crossing of approximately 2,750 vehicles for the low-growth scenario and 3,920 vehicles for the high-growth scenario. Both growth scenario forecasts are within the volume range typical for a two-lane arterial roadway.

5.2. Proposed Traffic Control

The Hazel Street railroad crossing will be grade-separated with either a structure crossing over the railroad tracks (an overcrossing) or a new road passing under the railroad tracks (an undercrossing).

5.2.1. Traffic Control with Hazel Street Undercrossing Option

Hazel Street/South Pacific Avenue is currently STOP-controlled with a less typical configuration for the three-leg intersection. Because the highest travel movements occur between the Hazel Street leg and the north leg of South Pacific Avenue, these movements flow freely while the south leg of South Pacific Avenue is stopped. With an undercrossing at Hazel Street, the intersection would go from three legs to four legs and alternative traffic control configurations should be considered.

5.2.1.1. Signal Warrant Analysis

From a traffic analysis standpoint, the option that will create the busiest intersection operations would be the undercrossing connection at South Pacific Avenue (Option 1). Therefore, signal warrants were evaluated for that intersection. Because traffic signals generate more average vehicle delay and typically have higher crash rates, a series of criteria or warrants were developed to identify when a traffic signal should be considered. The warrants used most frequently are traffic-volume-based; it is generally desirable for the 4-hour volumes or 8-hour volumes warrant to be met. Preliminary signal warrant analysis would suggest that under existing conditions, the vehicular volumes are not high enough to warrant a signal. Even with the high-growth scenario in 2035 and both at-grade crossings closed, volumes are not expected to warrant a signal at the intersection of Hazel Street and South Pacific Avenue.

5.2.1.2. STOP-Control Options

With the Hazel Street undercrossing option (Option 1), the intersection would go from three legs to four legs, and alternative STOP-control configurations should be considered. There are three typical configurations that could be applied:

- Two-way STOP control that stops traffic on Hazel Street and allows free movement of traffic on South Pacific Avenue.
- Two-way STOP control that stops traffic on South Pacific Avenue and allows free movement of traffic on Hazel Street.
- All-way STOP control that stops traffic on both Hazel Street and South Pacific Avenue.

Although traffic data were not available for peak hours, the daily volumes were assessed assuming that 10 percent of the traffic demand would occur during the peak hour and that 60 percent of the traffic would travel in the peak direction. Based on these assumptions, any of the three STOP-control configurations could be applied to the Hazel Street/South Pacific Avenue intersection with the expectation that stopped traffic would experience relatively short delays.

Two-way STOP control can be applied to all intersections created by the Hazel Street overcrossing options, which would have lower intersection volumes than the undercrossing option.

5.2.1.3. Cross-Section

A two-lane or three-lane cross-section for Option 1 would be adequate for the forecast traffic demand on Hazel Street. The advantage of the three-lane cross-section would be additional storage capacity in the short section of roadway that would connect between South Pacific Avenue east of the railroad tracks and Milwaukee Place west of the railroad tracks.

5.2.1.4. Traffic Circulation

The creation of a new railroad crossing at Hazel Street would cause some change in traffic circulation patterns in the area. Traffic to/from the north (i.e., residential neighborhoods, Three Rivers Mall, and downtown) would have to travel farther south than Yew Street/South River Road to cross the railroad tracks. This could result in more demand at the Mill Street crossing. Traffic volumes on South Pacific Avenue between Yew Street and Hazel Street might increase as drivers travel to the Hazel Street crossing. However, this increase might be offset by a reduction in traffic demand to/from the south (i.e., the industrial area and airport), since these drivers would have a shorter travel distance with the new crossing.

5.2.2. Traffic Control with the Hazel Street Overcrossing Options

The Hazel Street overcrossing options (Options 2A and 2B) would eliminate the Hazel Street intersection with South Pacific Avenue and route traffic onto Douglas Street instead.

5.2.2.1. Signal Warrant Analysis

Traffic demand at the Douglas Street/South Pacific Avenue intersection with Options 2A and 2B (Hazel Street overcrossing) would likely be lower than the demand at the Hazel Street/South Pacific Avenue intersection with Option 1 (Hazel Street undercrossing). Therefore, for Options 2A and 2B, signal warrants would not be met at the Douglas Street/South Pacific Avenue intersection.

5.2.2.2. STOP-Control Options

Options 2A and 2B (Hazel Street overcrossing) would eliminate the Hazel Street intersection with South Pacific Avenue and route traffic onto Douglas Street instead. Two-way STOP control could be applied to the Douglas Street/South Pacific Avenue intersection as well as the new intersections

created by the Hazel Street overcrossing options because all of these intersections would likely have lower volumes than the undercrossing option.

5.2.2.3. Cross-Section

A two-lane cross-section for a Hazel Street overcrossing would be adequate for the forecast traffic demand on Hazel Street. Because intersection spacing would be greater with these options, there is less need for additional storage created by turn lanes.

5.2.2.4. Traffic Circulation

In addition to the traffic circulation changes discussed for the Hazel Street undercrossing option, the overcrossing options would likely affect traffic demand on Douglas Street. Because Hazel Street would no longer connect directly to South Pacific Avenue with the overcrossing options, Douglas Street would become the primary travel route between South Pacific Avenue and Talley Way. Additional evaluation of the intersections along that route and of how an increase in traffic demand could affect traffic flow and safety is recommended.

5.2.3. Summary of the Results of Traffic Analysis

The traffic analysis revealed the following key findings:

- Two-way STOP control at the Hazel Street undercrossing intersection with South Pacific Avenue is adequate for both growth scenarios.
- Two-way STOP control can be applied to the Douglas Street intersection with South Pacific Avenue and the new intersections created by the Hazel Street overcrossing options.
- Given the estimate of peak-period and ADT volumes, a three-lane east/west roadway section for the Hazel Street undercrossing would generally provide for more than adequate operations through year 2035, although a two-lane facility would also work.
- A two-lane east/west section for the Hazel Street overcrossing would provide sufficient capacity.
- A traffic signal would not be warranted for any scenario or option.

6. Options Evaluation Process

6.1. Stakeholder Involvement and Coordination

A key Stakeholder Group was created to review design concepts from the consultant team; provide community and agency perspective regarding background, key issues, and impacts; and offer guidance and feedback throughout the project evaluation process. The Stakeholder Group included representatives from:

- City of Kelso Engineering
- City of Kelso Planning
- Cowlitz-Wahkiakum Council of Governments (CWCOG)

- Cowlitz County Engineering
- Washington State Department of Transportation Local Programs
- Washington State Department of Transportation Rail
- Three Rivers Golf Course

Four stakeholder meetings were held from September 2011 to March 2012. The meetings progressively reviewed project options, impacts, prioritization of key issues, development of evaluation criteria, costs, community impacts, rail-related issues and the HSR program, and funding needs and opportunities. Along with the evaluation process, discussion and feedback at the meetings helped shape the crossing options. These meetings were followed by an open house in April 2012 that focused primarily on the affected area. Appendix H contains the meeting notes and open house materials.

6.2. Evaluation Criteria

Evaluation criteria were developed in response to key issues raised by the Stakeholder Group and City staff. The City and the key stakeholders narrowed the list to eight key criteria. The criteria were prioritized to compare the advantages and disadvantages of each option. Each criterion was weighted based on prioritization, using a scale of 1 (lower priority) to 10 (higher priority). It was emphasized that elements receiving lower priority than others are not unimportant; rather, being on the list of criteria implies that a particular issue is considered extremely important. The prioritization and weighting is meant to reflect the importance of a particular issue relative to the other issues for this particular project.

The criteria, their weighted values, and scoring are described as follows:

1. *Neighborhood Safety*. Weighted 10 points. (What is the relative safety of the option based on increased traffic to residential areas, and safest environment for nonmotorized users? Scoring: 5 for best; 1 for worst.)
2. *Construction Costs*. Weighted 9 points. (Which option costs the least? Scoring: 5 for lowest; 1 for highest.)
3. *Complete Property Acquisitions*. Weighted 7 points. (Which option requires the fewest number of complete acquisitions of lots/buildings? Scoring: 5 for least impact; 1 for most impact.)
4. *Constructability*. Weighted 7 points. (Which option has the lowest risk for potentially significant impacts to safety, cost, or construction feasibility during construction? Scoring: 5 for least; 1 for highest.)
5. *Environmental Impact*. Weighted 5 points. (Which option has the least impact on the natural and built environments and, therefore, has the least risky environmental documentation process? Includes natural resources, visual, and socioeconomic/economic issues. Scoring: 5 for lowest; 1 for highest.)

6. *Redevelopment Opportunity*. Weighted 4 points. (Which option creates opportunities for future redevelopment of either remnant parcels of land remaining, or on land adjacent to the realignment? Scoring: 5 for most opportunities; 1 for least.)

7. *Long-Term Maintenance*. Weighted 4 points. (Which option commits the City to the highest long-term maintenance cost? Scoring: 5 for best; 1 for worst.)

8. *Partial Property Acquisitions*. Weighted 3 points. (Which option has the least overall need to acquire land from existing properties? Scoring: 5 for least impact; 1 for most impact.)

Each of the five options was then evaluated against the others based on the evaluation criteria and ranked from 1 to 5. A weighted score was then calculated multiplying the weight of each respective criterion by its ranking and then totaling the scores. The highest possible score was 245.

6.3. Results of Options Evaluation

The results of the weighted total scores are shown in Table 4 below.

Table 4. Summary Results of Options Evaluation

Hazel Street Crossing Location			Hawthorne Street Crossing Location	
Option 1 - Under	**Option 2A - Over**	**Option 2B - Over (Raise S Pacific Ave)**	**Option 3 - Under**	**Option 4 - Over**
176	213	117	83	107

The full scoring results for each option are included in Appendix I.

It is important to note that while Option 2A scored the highest, there appeared to be a clear separation between Options 1 and 2A at Hazel Street over the other options. This was primarily attributed to these options' lower likelihood of introducing additional through traffic into the neighborhood east of South Pacific Avenue, fewer property impacts, and lower environmental impacts from a new street extension near 13th Street. Underpass options become significantly more cost-prohibitive because of the shoo-fly, groundwater, and drainage issues.

A discussion of how the options met each evaluation criterion is provided below.

6.3.1. Neighborhood Safety

During the evaluation process, the most important criterion for any option was maintaining neighborhood safety. All of the grade-separated options will provide improved safety over existing at-grade crossings.

Option 1 limits local traffic impacts to the adjacent neighborhood to the east. The most significant change is the Hazel Street and South Pacific Avenue relocation and improvements to the South Pacific Avenue and Douglas Street intersection.

Option 2A is similar to Option 1, with the majority of traffic remaining on Hazel Street and South Pacific Avenue. However, this option extends South 3rd Avenue from Hazel Street to Douglas Street to maintain left-turn circulation from South Pacific Avenue into the neighborhood (and access onto the overpass). This introduces a new local circulation pattern through Douglas Street, South Pacific

Avenue, and Hazel Street. It also will require pedestrians to use a stairway or ramp to access the overpass.

Option 2B appears to have somewhat greater impacts than Option 2A because of the significant impact from raising South Pacific Avenue. A new access to the existing properties at the west end of Hazel Street would be required and the intersection of South Pacific Avenue and Virginia Street would also need to be raised to the new elevation of the roadway. There would be extensive construction of retaining walls that would restrict pedestrian circulation.

Options 3 and 4 introduce additional through traffic to Hawthorne Street, affecting traffic patterns with pedestrians and thereby neighborhood safety. Both options convert Hawthorne Street to a through street, effectively converting a local street to a collector.

6.3.2. CONSTRUCTION COSTS

BNSF and Amtrak need to maintain full operation through the corridor at all times. For any undercrossing option to be constructed, the project would need to provide a temporary shoo-fly designed to meet current capacity and design speeds. The cost of a temporary shoo-fly is estimated to be $15 million, which would be added to the cost of construction of all undercrossing options.

Option 1 is estimated at $51 million for design and construction, which includes a temporary railroad shoo-fly and stormwater pump system.

Option 2A is estimated at $24 million for design and construction. This option would not require a temporary railroad shoo-fly nor would it require groundwater management.

Option 2B is estimated at $33 million for design and construction. This option is more expensive than Option 2A because of the increased length of retaining walls along South Pacific Avenue and Hazel Street.

Option 3 is estimated at $56 million. In addition to requiring a shoo-fly and groundwater management, it would also require roadway widening and right-of-way acquisition from several properties along Hawthorne Street and Virginia Street.

Option 4 is estimated at $28 million. In addition to the same improvements as under Option 2, it would require roadway widening and right-of-way acquisition from several properties along Hawthorne Street and Virginia Street.

6.3.3. COMPLETE PROPERTY ACQUISITIONS

Option 1 would eliminate fewer industrial buildings just east of South Pacific and south of Hazel Street in the MH (Kelso) zone than Options 2A and 2B. Most of the alignment crosses property that is underdeveloped or undeveloped in AG (Cowlitz County), OPN (Kelso), RMF (Kelso), and RSF-10 (Kelso) designations.

Option 2A would directly impact several industrial buildings on Hazel Street, and possibly reconstruct accesses on Douglas Street. Option 2B would have industrial displacement impacts east of the tracks that are similar to Option 1. However, Option 2B angles through the area, potentially

displacing structures near River Road, although the impacts might be able to be minimized depending on details of final design.

Options 3 and 4 would acquire full properties on commercially zoned (C-2) and residentially zoned land just east of the tracks. At least one full industrially zoned parcel (ILM) would be acquired at 13th Avenue. Land and/or residences (zoned RSF-10) would be acquired for the new right-of-way along the Option 3 and Option 4 alignments to South River Road.

6.3.4. CONSTRUCTABILITY

Major constructability issues with the undercrossing Options 1 and 3 include addressing groundwater and significant impacts from the footprint that a shoo-fly creates. The shoo-fly would require temporary easements along several properties west of the railroad tracks, and groundwater would need to be managed during construction. South Pacific Avenue will most likely have to be temporarily closed during construction.

Option 2A has the least constructability issues of all the options presented, because overpass work can be done without major impact to the railroad and local traffic.

Option 2B would have more complex staging and traffic control than Option 2B because of the need to raise the elevation of South Pacific Avenue. Maintaining traffic flows during construction would be challenging. Significant rerouting of motor vehicle traffic would be required, as well as making sure rail traffic is not impacted.

Option 4 has similar constructability issues to Options 2A and 2B, but has additional issues such as a second crossing of sensitive areas and conversion of a residential street into a collector road.

6.3.5. ENVIRONMENTAL IMPACTS

6.3.5.1. Land Use

In general, Options 1, 2A, and 2B are more compatible with existing uses than Options 3 and 4. The greater consistency comes from the location of the alignments, which separate the recreation uses in the south of the area and the largely residential uses to the north. The alignments of Options 1, 2A, and most of Option 2B cross property that is underdeveloped or undeveloped in AG (Cowlitz County), OPN (Kelso), RMF (Kelso), and RSF-10 (Kelso) designations. Option 2A, east of the tracks, is likely to cause increased traffic along the new connection between Douglas Street and Hazel Street, possibly attracting more traffic closer to the residential area. West of the tracks, Options 2A and 2B would separate the residential area to the north from the recreation development to the south, similar to Option 1. Both Hawthorne options (Options 3 and 4) would tend to bisect the residential area west of the tracks and are likely to add additional recreation and possibly future industrial traffic through the residential neighborhoods east and west of the tracks. The addition of such traffic may adversely impact the livability of the neighborhoods more than the other options would.

6.3.5.2. Visual Quality

Visually, the bridge would dominate the immediate area, since the approach would be raised. It was considered in the evaluation process that the overpass Options 2A and 2B and 4 would have the greatest visual impact because they are located closest to the study area.

6.3.5.3. Wetlands

All options would impact the wetland swale. Options 1, 2A, and 2B would have the smallest impacts. Options 3 and 4 would have a larger impact on wetlands because they would cross presumed sensitive areas just west of South 13th Avenue.

6.3.5.4. Hazardous Materials

The consultant team accessed existing databases on the Washington Department of Ecology website for reports of hazardous materials. Relevant hazmat site databases were searched for sites within one-quarter mile of the study area. The searches revealed 15 underground storage tanks at six sites, which are shown on the map below. The table in Appendix J lists the addresses and status of the underground storage tanks. All are either closed in place, in operation, or removed.

Figure 14. Hazardous Materials Search Results

6.3.6. REDEVELOPMENT OPPORTUNITY

All options could encourage future growth in the area because of enhanced access. There are approximately 65 acres of land zoned RSF-10. A maximum build-out could contain up to 260 single-family residences based on a maximum build-out of four units per acre. The actual density would depend on land needed for streets, and any site or building constraints, such as critical areas.

Perhaps 15 acres of land south of the unincorporated area is zoned RMF, Residential Multifamily, which allows a maximum density of 32 units per acre. Thus, more than 400 multifamily units could be permitted, again, not accounting for site constraints such as wetlands. West of River Road there is another area of RMF-zoned land and a pocket of land zoned ILM. However, this area's proximity to the shoreline, the potential presence of other critical areas, and the lack of access could prevent the land from being developed for the zoned densities and uses.

Future development hinges somewhat on the timing for provision of sanitary services to the residential areas not currently served as well as incorporation of the AG area, if appropriate. Options 1 and 2A, by providing a logical separation of residential from recreation and industrial zones, could be more likely to attract future development. Option 2B would remove more residential and industrial land from future development than Options 1 and 2A. The Hawthorne Street alignment options are likely to remove the most amount of land available for development or redevelopment in commercial, industrial, agricultural, and residential designations because of the extension to South 13th Avenue.

However, future development under any of the options may also depend on clarifying the vision for the area by reconciling the plan and zoning inconsistencies, and on the presence of existing nonconforming uses, as discussed earlier in this report. These include the residential large lot patterns west of the tracks, the comprehensive plan references to a proposal for a regional shopping mall to replace the golf course, and the planned retail/commercial/office designation on the Land Use Plan for Kelso.

6.3.7. Long-Term Maintenance

All options would require maintenance of the roadway, retaining walls, and water quality facilities for the life of the road. The undercrossing Options 1 and 3 would have the greatest long-term maintenance requirements due to the need for a pump station for storm drainage and fluctuating groundwater. Option 2B would follow as requiring the next-greatest level of long-term maintenance because of the increased number of retaining walls that are part of this option. The overcrossing Options 2A and 4 would require the least amount of maintenance compared to the other options, but would require the maintenance associated with a longer structure over South Pacific Avenue and the BNSF tracks.

6.3.8. Partial Property Acquisitions

Under Option 1, a corner of the Three Rivers Golf Course property would be acquired for the roadway, and the shoo-fly would temporarily impact the northeastern boundary of the Three Rivers Golf Course. Options 2A and 2B would also acquire a corner of the golf course property for the roadway, but because there would be no shoo-fly required, it would avoid the temporary impacts of Option 1 on the golf course. Options 3 and 4 would acquire partial rights-of-way to the east and west of the tracks.

7. RECOMMENDATION

At the September 2011 Stakeholder Group meeting, the following options were presented: Hazel Street undercrossing and overcrossings, and a Hawthorne Street alignment. General discussion included the typical section, design (arterial or collector), and design speed. Other issues discussed were emergency response times and the closure of both at-grade crossings, airport height restrictions (a maximum of 44 feet), bicycle and pedestrian connectivity, utilities, intergovernmental agreements, and the addition of representatives from the airport and the diking district to the Stakeholder Group. At this meeting, it was recommended that we focus on a crossing at the Hazel Street location, shown in Options 1 and 2.

At the December 2011 Stakeholder Group meeting, modified typical sections were presented, along with more advanced designs showing retaining wall locations, potential drainage and water quality issues, groundwater information, and airport flight path information. The pros and cons of three options were discussed: Option 1, Undercrossing at Hazel; Option 2A, Overcrossing at Hazel (with Douglas Street or Virginia Street connections); and Option 2B, Overcrossing at Hazel (raises South Pacific Avenue). Other topics raised for discussion were: sight distance issues at the connection to South River Road, straight alignment versus curvature approaching River Road to minimize building impacts (west of the tracks), traffic impacts to the residential neighborhood east of South Pacific Avenue, and impacts and challenges of the Hawthorne options that appear to make the Hazel options preferable.

Based on the evaluation process, the Hazel Street overcrossing Option 2A was recommended as the preferred option for further development. The recommendation is based on the fact that the Hazel Street overcrossing option provides the most optimal balance in regard to the evaluation criteria.

8. FUNDING STRATEGY

With gas and sales tax revenues in decline, this is a very difficult time to seek funding for new projects. Thus, in the near term, the strategy should be to focus on preparing the needed information and a network of support so that the project will be well positioned to take advantage of funding opportunities. The timing for such an opportunity is dependent upon external events such as an economic recovery, development needs to the west of the track, and the Kelso–Martins Bluff Project.

The City's strategy should include developing the following:

- Use of this study to show the need for the project and preferred crossing location
- Local support for the project, including an individual to act as a champion for the project, if possible
- A capital reserve to use as a local match when state and federal funds become available

8.1. POTENTIAL FUNDING SOURCES

8.1.1. LOCAL

- City budget – including allocations from the state from gas tax and vehicle registration.
- Public Works Trust Fund – www.pwb.wa.gov.

8.1.2. SYSTEM DEVELOPMENT CHARGES

- Transportation
- Stormwater

8.1.3. STATE

- **Washington Utilities and Transportation Commission (Commission), Grade Crossing Protective Fund (GCPF).** This fund provides grants for projects that eliminate or mitigate public safety hazards at railroad crossings and along railroad rights-of-way in Washington State. Any public, private or nonprofit entity may submit an application to the Commission for a GCPF grant– http://www.utc.wa.gov/publicSafety/railSafety/Pages/gradeCrossingProtectionFundGrants.aspx
- **Washington State Department of Transportation, Highways and Local Programs.** The "Safe Routes to School" program provides funds to improve safety and mobility for children. The purpose is to enable and encourage them to walk and bicycle to school. Funding from this program is for projects within two miles of primary and middle schools (K-8) and will be targeted to address engineering improvements, education and encouragement activities, and enforcement.

  The Google Maps "directions" feature measures the distance between Milwaukee Place and Wallace Elementary School as approximately one mile, using the Yew Street crossing, potentially qualifying that crossing for funding– http://www.wsdot.wa.gov/localprograms/
- **Washington State Department of Transportation, Highways and Local Programs.** WSDOT distributes federal safety money to cities and counties in Washington State to reduce fatal and serious injury collisions. Funds come from the Federal Transportation Act (SAFETEA-LU). Washington State's plan is called Target Zero. The City Safety Program and the County Safety Program fund improvements to reduce fatal and serious injury collisions on city and county streets (and managed access to state highways in cities with a population above 25,000). The City Safety Program distributes funds from SAFETEA-LU's Federal Highway Safety Improvement Program (HSIP). The County Safety Program distributes funds from SAFETEA-LU's Federal HSIP and High Risk Rural Roads Program (HRRRP). The most recent projects were selected in early 2012. Contact the Traffic Services Manager for more information.
- **Transportation Improvement Board.** The Washington State Legislature created the Transportation Improvement Board (TIB) to foster state investment in quality local transportation projects. The TIB distributes grant funding, which comes from the revenue generated by three cents of the statewide gas tax, to cities and counties for funding transportation projects. The TIB provides funding for population centers of

over 5,000 through three grant programs: Urban Arterial Program, Urban Corridor Program, and Urban Sidewalk Program (SP).

Eligible projects must be located within the federally designated urban area in compliance with the Growth Management Act. Projects are usually large in scale, with multiple funding sources ranging from local contribution to private developer fees. These projects are selected annually on a competitive basis. Each program has distinct characteristics for the best-suited project, and the Kelso railroad crossing may qualify under the Urban Corridor Program. The web page is: http://www.tib.wa.gov/grants/urban/UrbanOverview.cfm.

8.1.4. FEDERAL

- **Surface Transportation Program (STP).** STP funds are apportioned to states by formula, a portion of which must be used for safety (10 percent), enhancement (10 percent), and allocated by formula to urbanized and rural areas in the state. STP funds may be used for planning, construction, reconstruction, rehabilitation, and operational highway improvements.

  U.S. Department of Transportation – Rail Highway Crossing Hazard Elimination in High Speed Rail Corridors Program. Section 1103f of this funding source is administered by WSDOT's Rail Office. States along the 11 federally designated high-speed rail corridors are eligible to apply, including the Pacific Northwest Rail Corridor. This program, jointly administered by the FRA and the Federal Highway Administration, provides support for safety improvements at both public and private highway-rail grade crossings along federally designated high-speed rail corridors.

- **U.S. Department of Transportation – Elimination of Hazards Relating to Railway-Highway Crossings. Title 23 provide**s for the funding of highway maintenance and repair, to be implemented by state departments of transportation. Section 1401(d) allows funds for the cost of construction of projects for the elimination of hazards of railway-highway crossings, including the separation or protection of grades at crossings, the reconstruction of existing railroad grade crossing structures, and the relocation of highways to eliminate grade crossings. WSDOT is the agency that manages these funds through the Highways and Local Programs, described above.

- **U.S. Department of Transportation – Capital Grants for Rail Line Relocation and Improvement Projects.** This program provides support to construction projects undertaken for the improvement of the route or structure of a rail line that meet the following criteria: are carried out for the purpose of mitigating the adverse effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, or economic development; or involve a lateral or vertical relocation of any portion of the rail line. Eligible construction projects include locating, surveying, and mapping; track and related structure installation, restoration, and rehabilitation; acquisition of rights-of-way; relocation assistance, acquisition of replacement housing sites, and acquisition and rehabilitation, relocation, and construction of replacement housing; and elimination of obstacles and relocation of utilities. Eligible pre-construction activities are also supported. The application deadline is in fall 2012.

8.2. FUNDING STRATEGY RECOMMENDATIONS

To increase the chance of leveraging various funding sources in the future, the discussion should focus on highlights that address and connect the variety of issues, impacts, and challenges as the HSR program is built out in the region, including:

- Safety and livability of those in the affected community
- Increased rail crossing safety necessary for pedestrians, bicyclists, and motor vehicles
- Increased transportation connectivity
- Stormwater treatment benefits
- Potential developments to the west of the BNSF tracks

The funding strategy should be discussed with local, state, and federal officials to assess their willingness to help, hear their suggestions, make revisions, and prepare for next steps. The coalition might include the following groups:

- City of Kelso
- WSDOT Rail
- Property owners in the area
- Development interests west of the BNSF tracks
- Community groups such as the Kelso-Longview Chamber of Commerce

In preparing to request funding, the City of Kelso should prepare an amendment to the Statewide Transportation Improvement Program (STIP). Projects must be in the STIP to be eligible for state and federal funding. The schedule for adding a project to the STIP is shown on the web page www.wsdot.wa.gov/LocalPrograms/ProgramMgmt/STIP.htm.

9. NEXT STEPS

It is important to maintain the momentum initiated by this study process. The Kelso–Martins Bluff Project portion of the HSR program will proceed and is scheduled for completion in 2017. The approximate timeline for a grade-separation project by the City could take three to four years, allowing for preliminary and final engineering design, environmental documentation and approvals, bidding, and construction. This does not include the time needed to secure funding from the variety of sources that need to be considered.

The study effort represents the City's significant commitment to being proactive in addressing the impacts of the HSR project. This study provides a solid foundation for the City to work with BNSF, WSDOT, Cowlitz County, key stakeholders, and the affected area of the community as the HSR project moves forward. It prioritizes issues, and proposes solutions to challenges such as safety, connectivity, constructability, and cost. It also separates two intertwined efforts—a major railroad improvement with very broad regional benefits, and a local transportation connection that is necessary to maintain safety for residents, commuters, and businesses. South Pacific Avenue serves as a major north/south connection in the area that serves City and County citizens.

Funding for public works projects is extremely competitive. Jurisdictions that invest resources, as the City has done, to examine and solve critical issues before submitting funding applications often have a competitive advantage over other proposed projects that have not invested in such a process. The partnering spirit developed through the stakeholder process should be continued to build support for completion of the grade-separation project. This type of support is essential in positioning for funding, and in addressing the long-term impacts of the HSR program with residents and businesses, not only in Kelso but also in neighboring Cowlitz County.

The following is a brief summary of steps to be taken to bring the grade-separation project to completion:

- Coordinate with BNSF and WSDOT for the HSR program (scheduled completion 2017) – Be an active stakeholder to the highest degree possible. During the design process there are often opportunities to solve various design issues. City staff should maintain close contact with BNSF and WSDOT to stay abreast of the HSR program schedule and design details, understand where available options are presented in the design that could help facilitate the grade-separation project, and use that relationship to help build wider regional support for funding.

- Seek regional support and funding – Circulate among partner agencies represented in the Stakeholder Group to develop support to compete for funding at the state and federal level. Actively apply for and seek funding from available sources. Build support, urgency, and enthusiasm among City stakeholders such as the City Council. Use materials developed in the study to reach out to constituents of the CWCOG as well as others, such as the Cowlitz County Commissioners, as opportunities present themselves.

- Engineering design – Although not yet scheduled due to funding, consider developing a program in which sufficient survey and design could be started quickly and accomplished in

order to move into the environmental clearance process. Final design must be completed in order to finalize land acquisitions and bid the project, but it is important to move into the environmental approval process as early as possible.

- Obtain environmental approvals – This process often becomes the critical path. There are a number of issues to be fully documented, such as geotechnical and environmental justice issues, and impacts on environmentally sensitive areas. It is necessary to obtain all environmental clearances to use federal funding to purchase right-of-way. This project will require several complete acquisitions as well as a number of partial land acquisitions that are not fully identified in this study due to its preliminary nature.

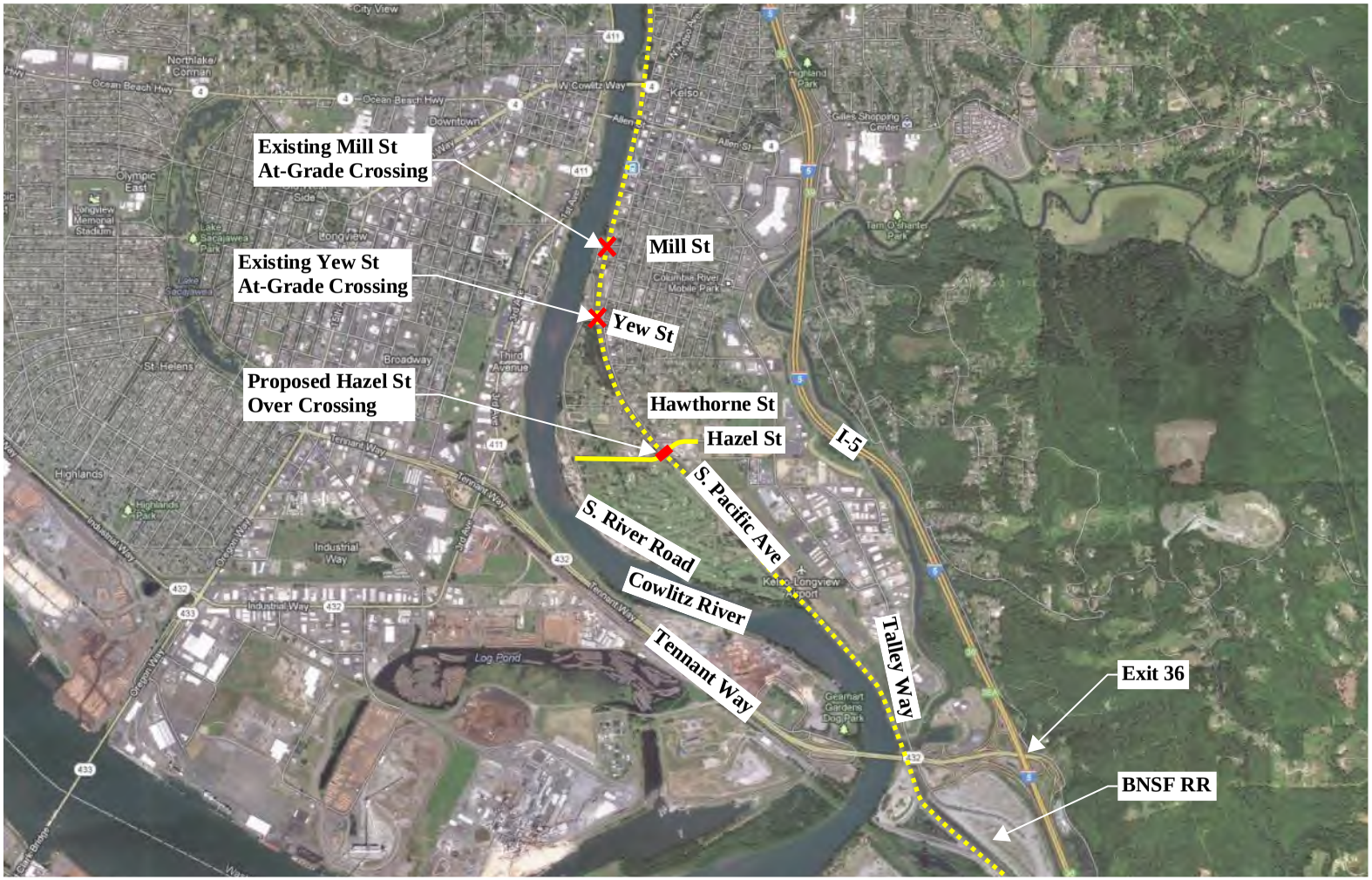
- Right-of-way acquisition – As early as possible in the preliminary design process, consider identifying the complete acquisitions, so appraisals can occur early on.

- Construction – The overcrossing options allow more flexibility to separate the HSR schedule from the grade-separation project schedule. To avoid potential complications and safety issues with access across the railroad right-of-way during construction (for example, residents, emergency services, and golf course users), careful consideration of how to stage and sequence the grade-separation project during preliminary design is needed. Advanced coordination with area residents, businesses, and emergency services will be necessary.

Appendix A

Plan Sets and Conceptual Cost Estimates

NO SCALE



Existing Mill St At-Grade Crossing

Existing Yew St At-Grade Crossing

Proposed Hazel Street Over Crossing

S KELSO RR CROSSING STUDY

VICINITY MAP

DAVID EVANS AND ASSOCIATES INC.
3700 Pacific Hwy. East, Suite 311
Tacoma, Washington 98424
Phone: 2533223780

REVISIONS: APPD.

DATE: 29 Jan 2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

DRAWING FILE:

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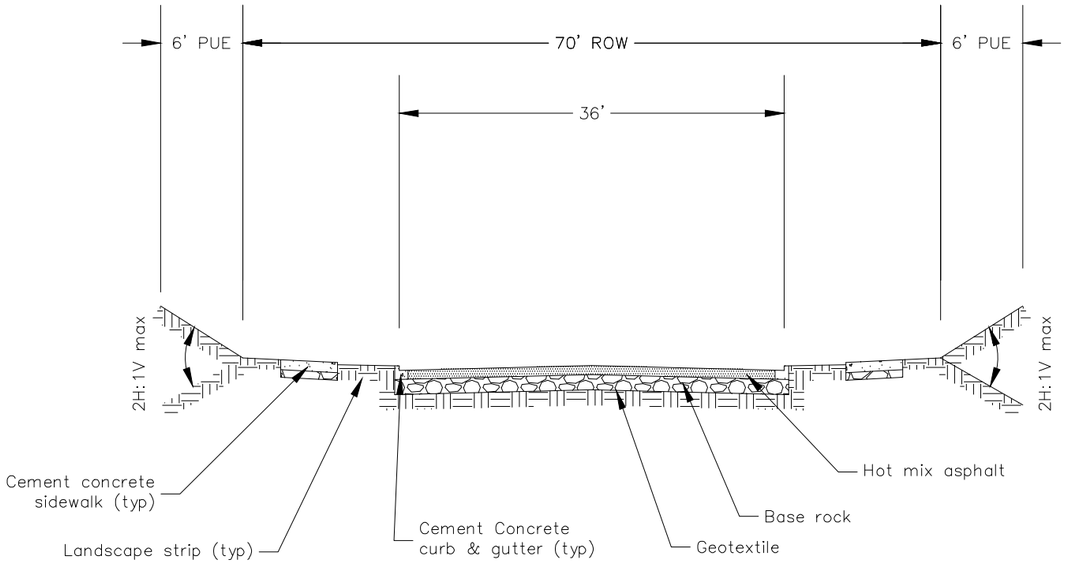
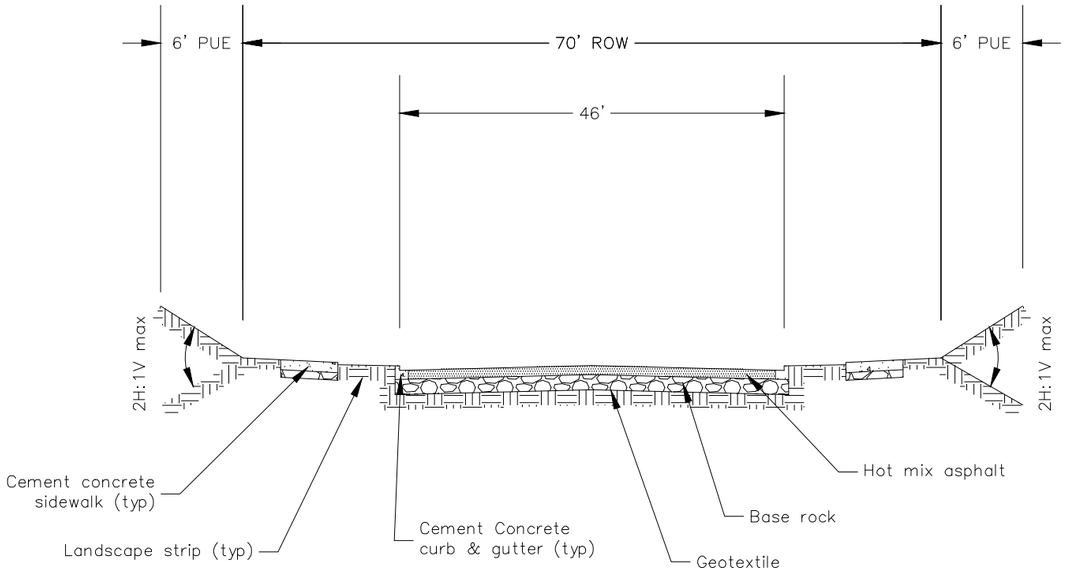
SHEET OF



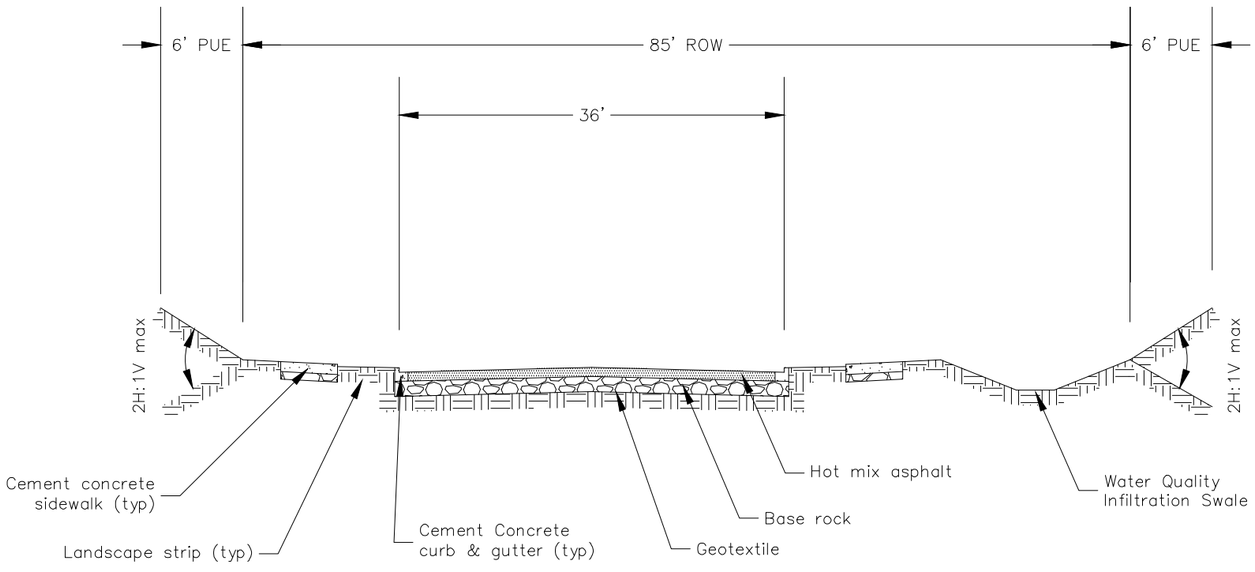
Typical Section: Modified Collector

N.T.S.
HAZEL ST WEST OF RR XING
S 3RD AVE (HAZEL ST TO DOUGLAS ST)
DOUGLAS ST (S PACIFIC AVE TO S 3RD AVE)



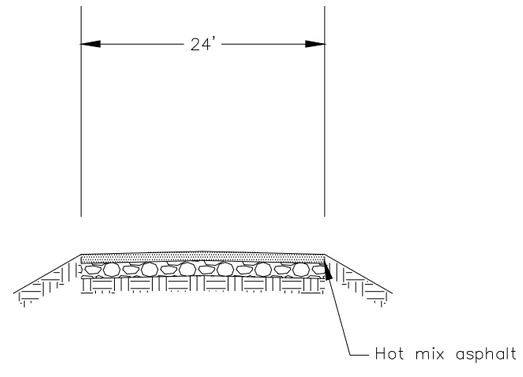
Typical Section: Modified Minor Arterial

N.T.S.
HAZEL ST
EAST OF RR XING



Typical Section: Modified Collector With Swale

N.T.S.
HAZEL ST WEST OF RR XING



Existing Section: S. Pacific Avenue

N.T.S.

S KELSO RR CROSSING STUDY

TYPICAL SECTION

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER: NUMBER

SCALE: AS SHOWN

PROJECT NUMBER:
KESO00000002

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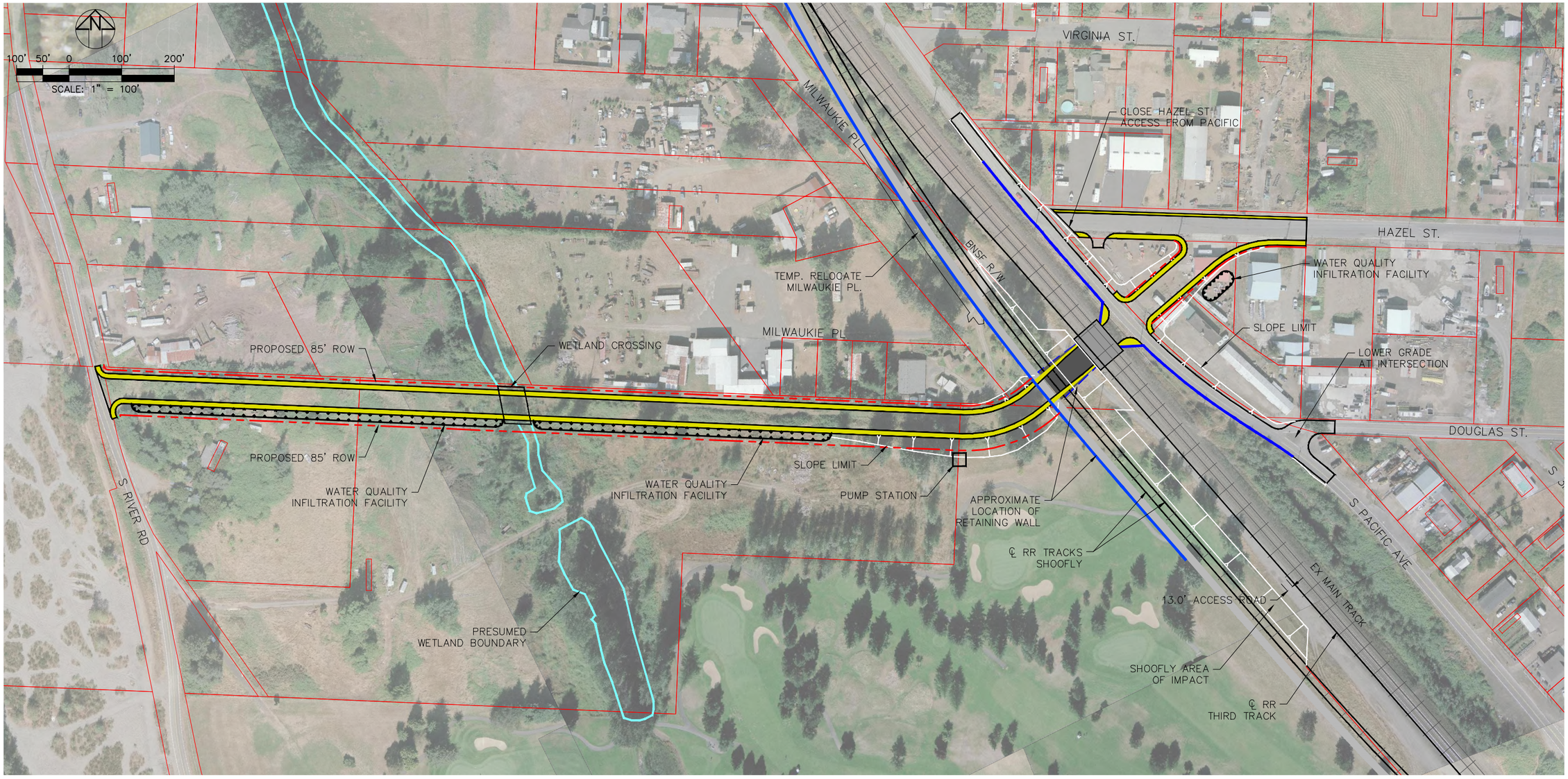

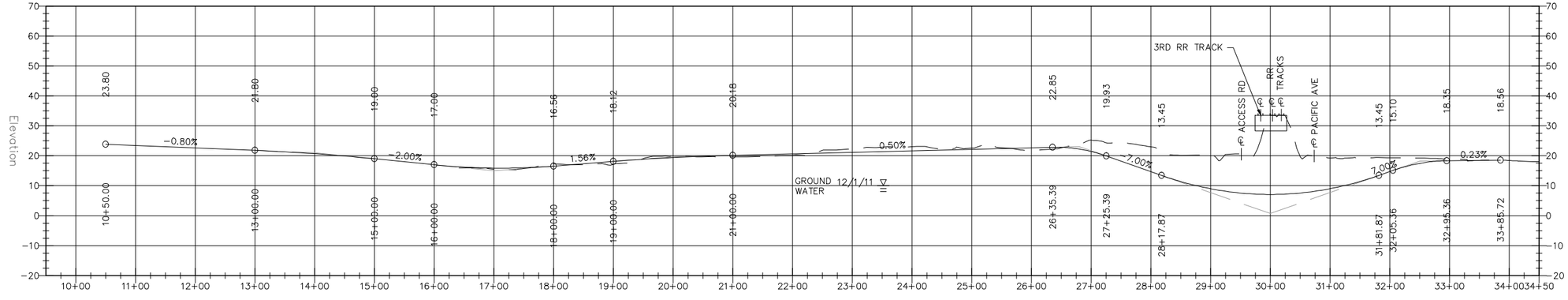

S KELSO RR CROSSING STUDY

OPTION 1 UNDER CROSSING
HAZEL ST PLAN & PROFILE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland, Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

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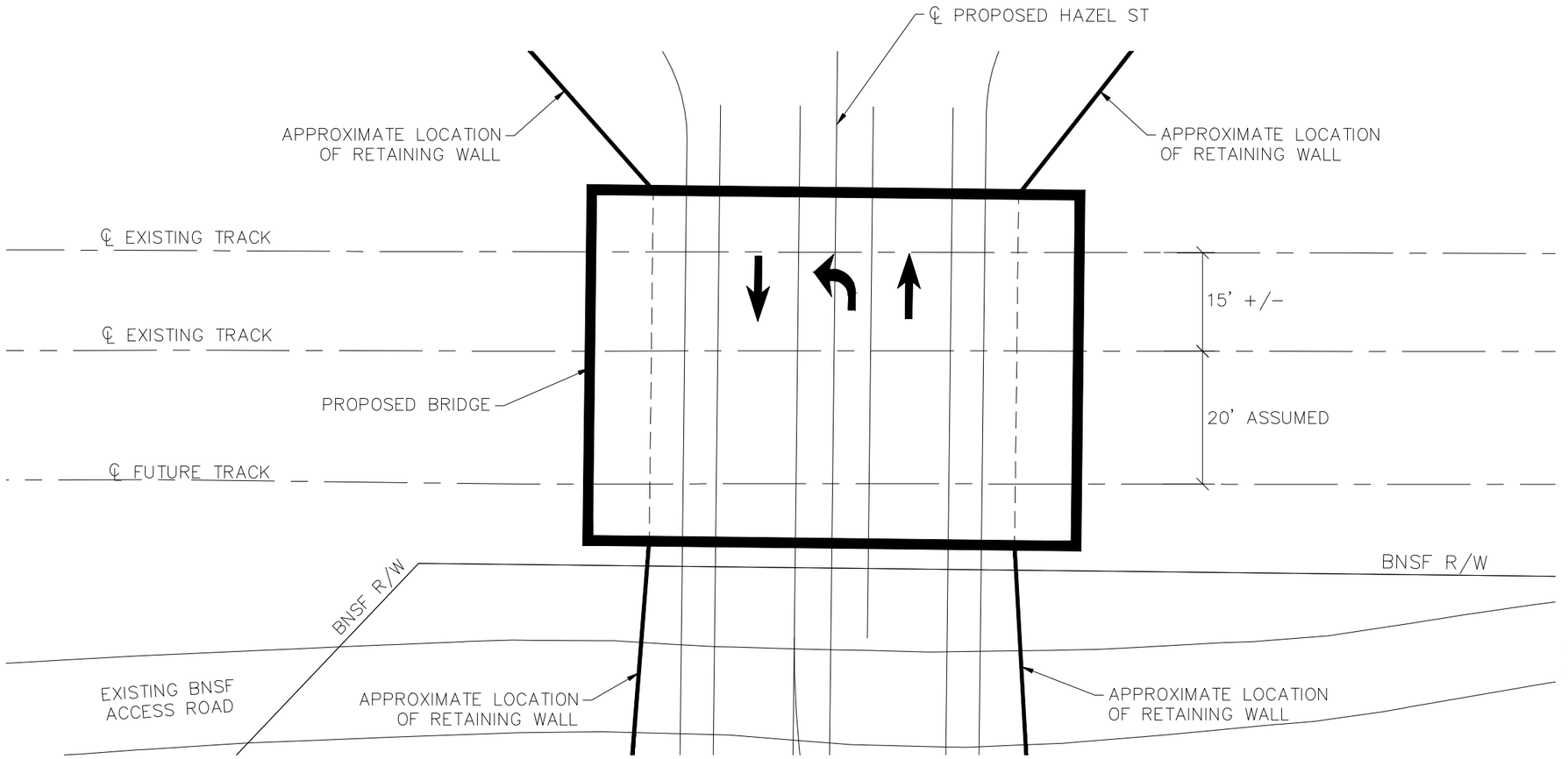
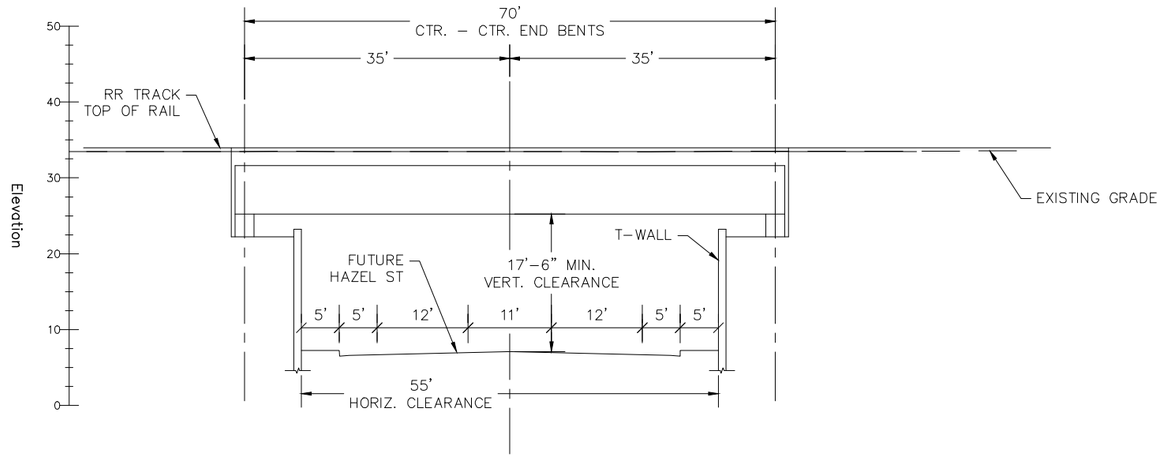


PLAN
SCALE: 1"=20'



ELEVATION
SCALE: 1"=10'

S KELSO RR CROSSING STUDY

OPTION 1 UNDER CROSSING SINGLE SPAN BRIDGE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER: NUMBER

SCALE:

PROJECT NUMBER:
KESO00000002

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keso0002_bridge_option1.dwg

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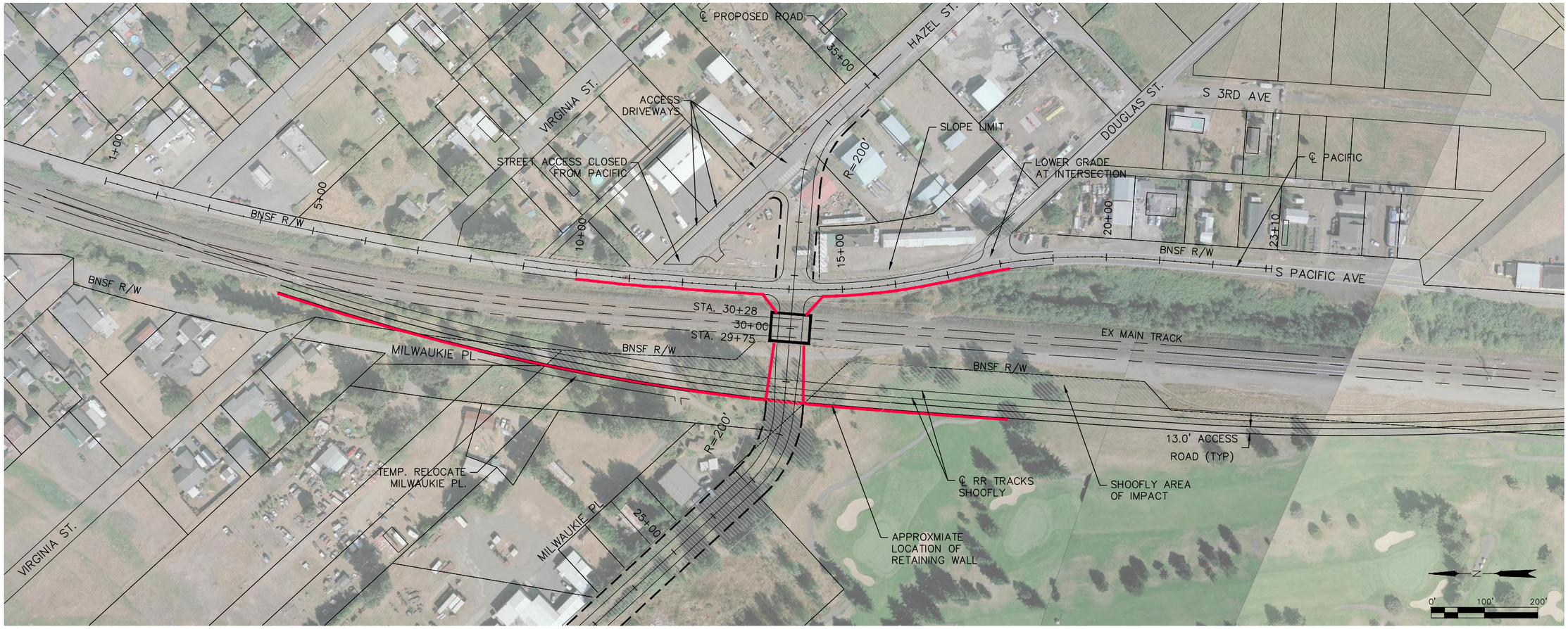

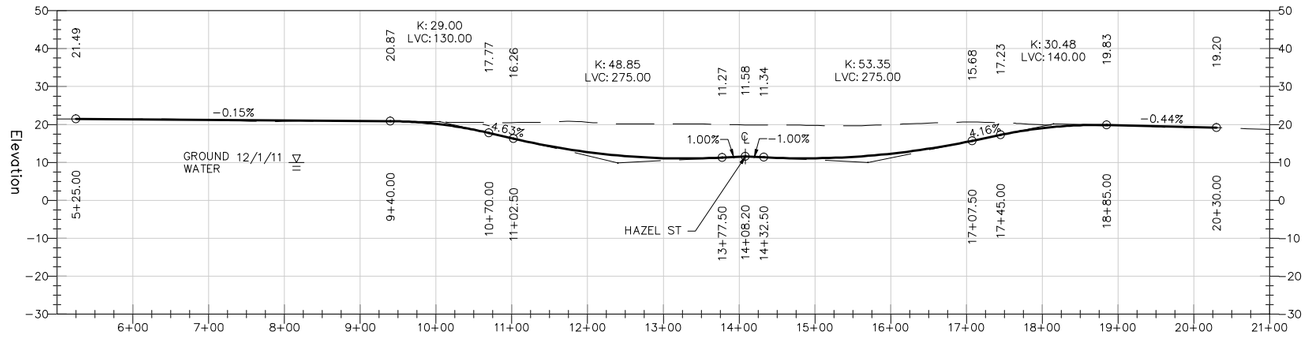

S KELSO RR CROSSING STUDY

OPTION 1 UNDER CROSSING
PACIFIC PLAN & PROFILE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER: NUMBER

SCALE: 1"=100'

PROJECT NUMBER:
KESO00000002

DRAWING FILE:
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NOTES:
1. DESIGN SPEED FOR 1°20' CURVE IS 80 MPH FOR PASSENGER AND 55 MPH FOR FREIGHT.

2. LOCATION OF RELOCATED TURNOUT AT MP 99.43 AND CROSSOVERS BETWEEN MP 99.85 TO MP 100.02 ARE NOT SHOWN.

OPTION 1 UNDER CROSSING
CONCEPTUAL SHOOFLY

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 3/1/2013
DESIGN: MFM
DRAWN: CDB
CHECKED:
REVISION NUMBER:

SCALE: 1"=150'

PROJECT NUMBER:

DRAWING FILE:
keso0002_shoofly.dwg

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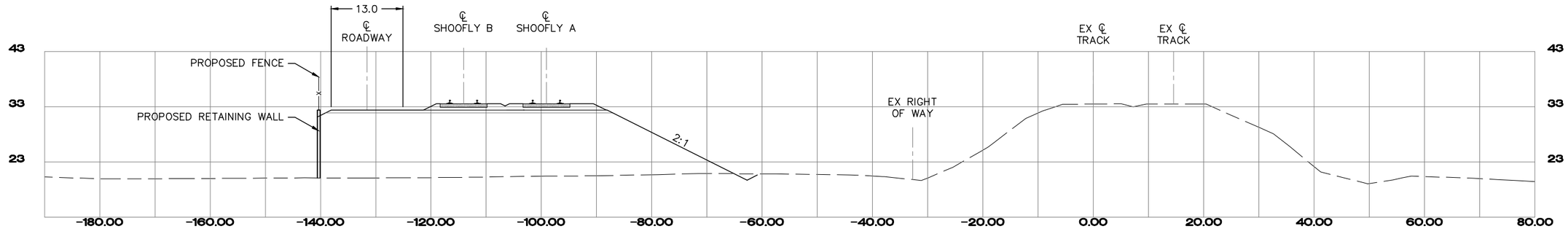

A
1 | 1
SECTION A–A
1" = 20'

OPTION 1 UNDER CROSSING
SHOOFLY CROSS SECTION

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY
CONTENT
SUBJECT TO
CHANGE

REVISIONS: APPD.

DATE: 3/1/2013
DESIGN: MFM
DRAWN: CDB
CHECKED:
REVISION NUMBER:

SCALE: 1"=20'

PROJECT NUMBER:

DRAWING FILE:
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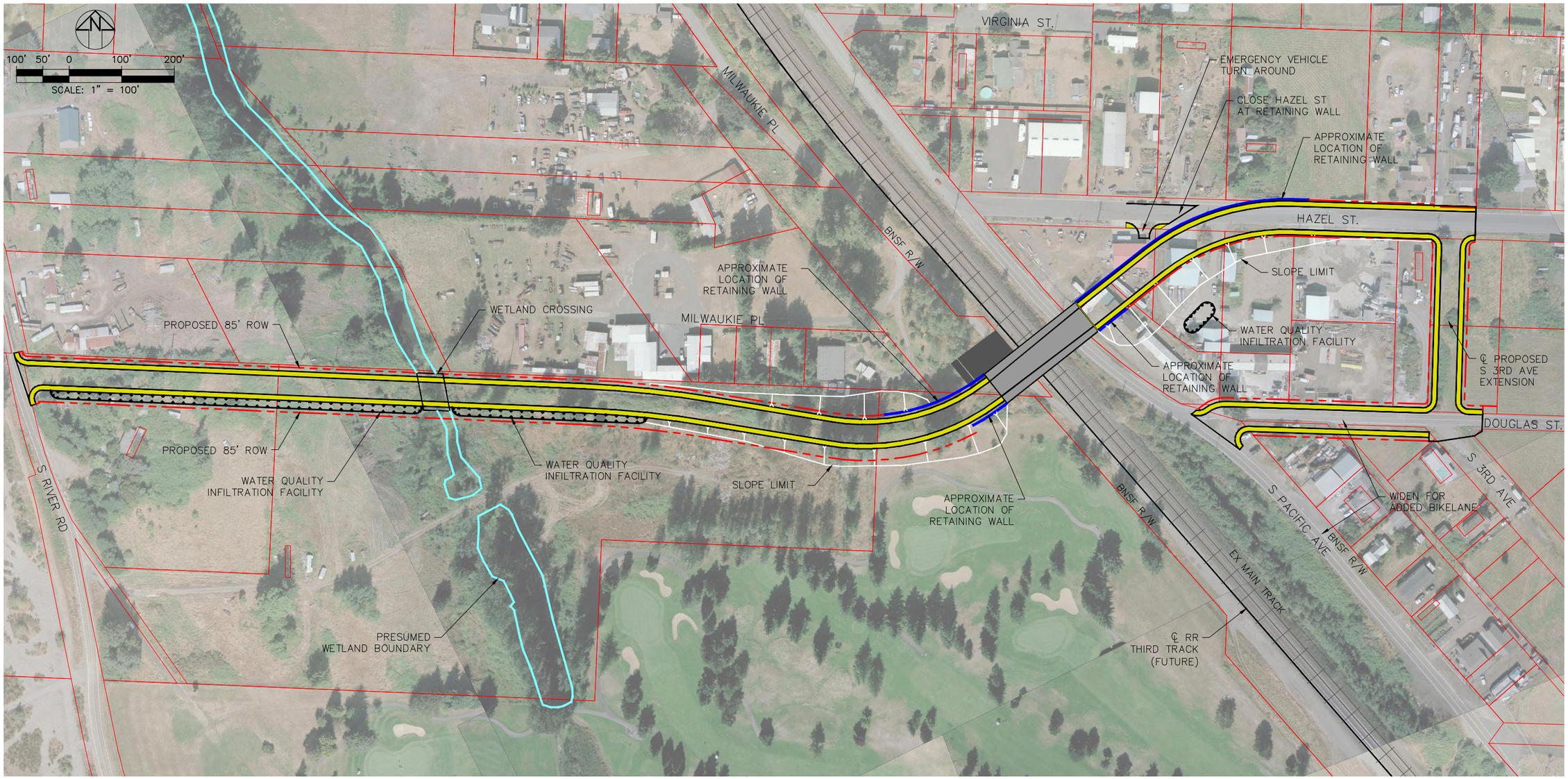

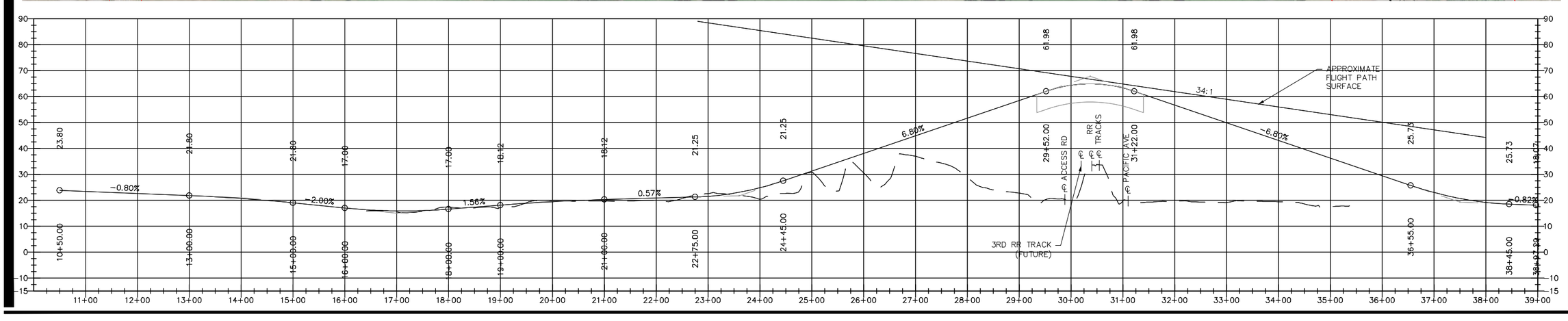

S KELSO RR CROSSING STUDY

OPTION 2A OVER CROSSING
HAZEL ST PLAN & PROFILE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland, Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

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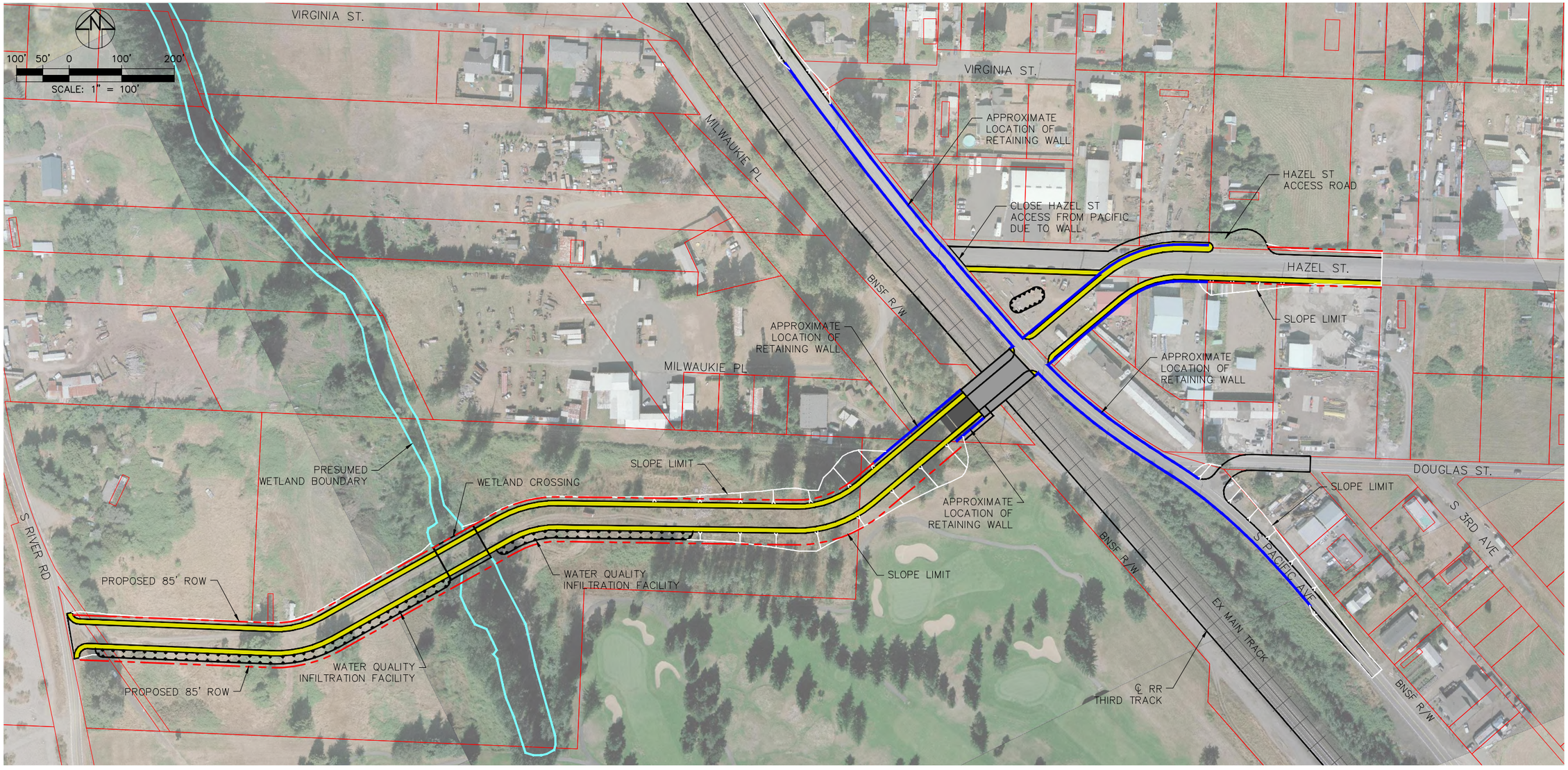

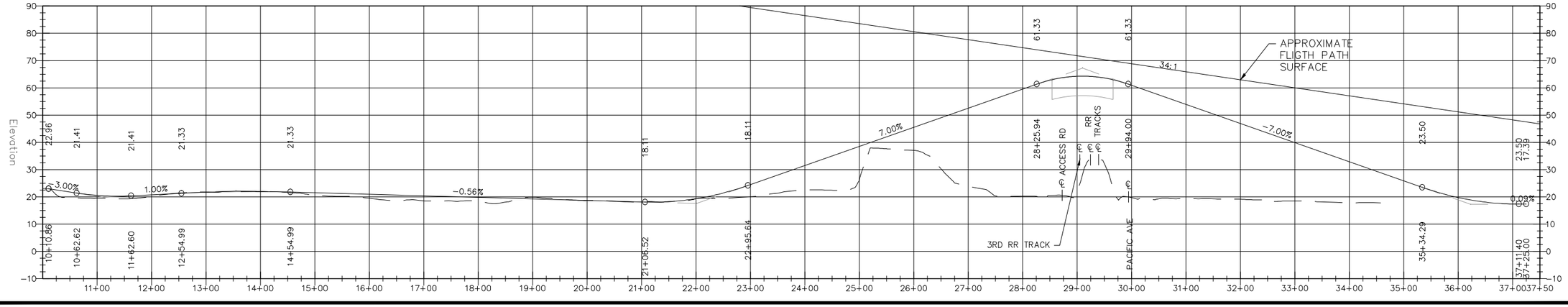

S KELSO RR CROSSING STUDY

OPTION 2B OVER CROSSING
HAZEL ST PLAN & PROFILE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS: APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

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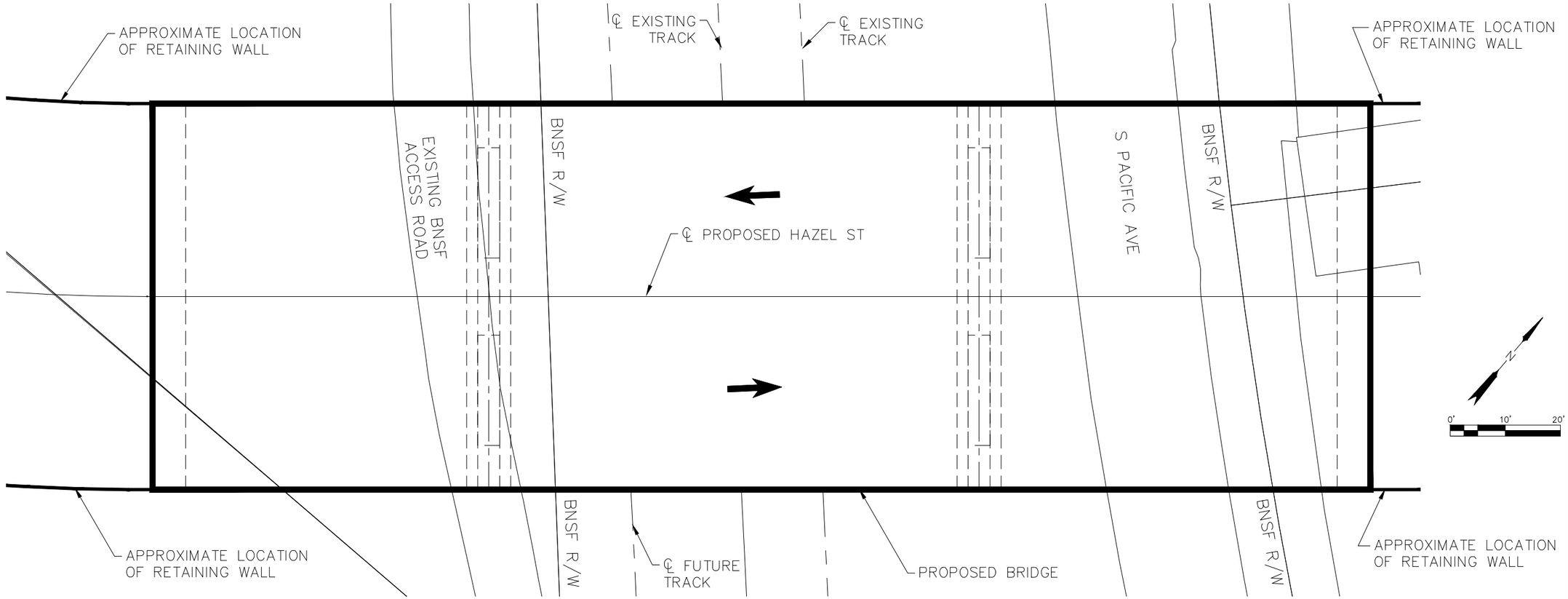
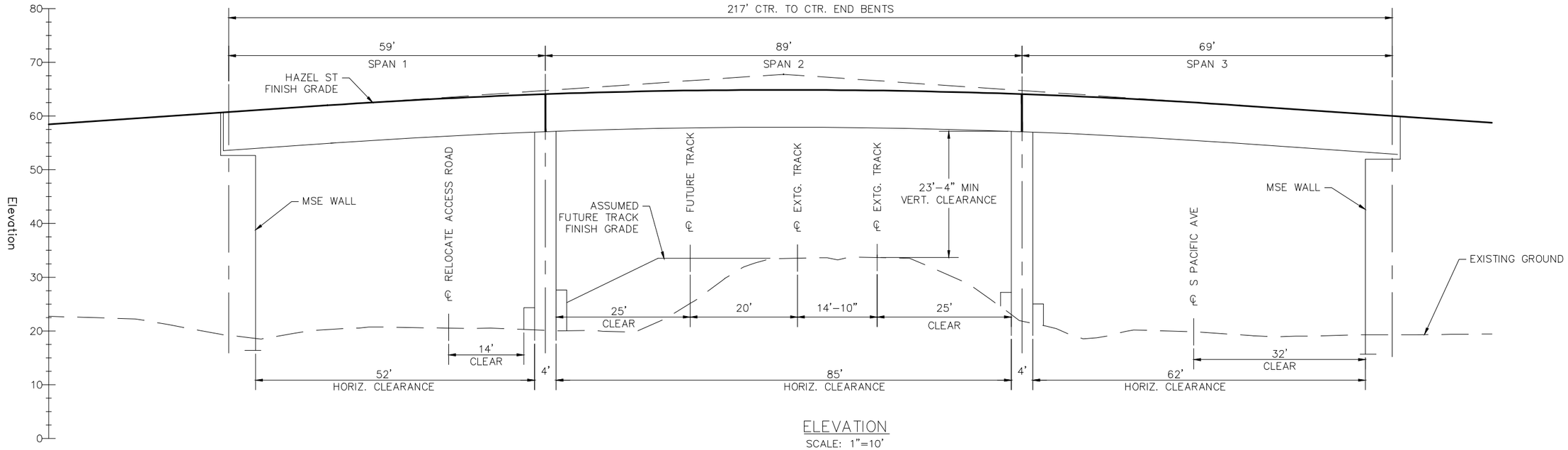


PLAN
SCALE: 1"=20'



ELEVATION
SCALE: 1"=10'

S KELSO RR CROSSING STUDY

OPTION 2A OVER CROSSING
THREE-SPAN BRIDGE

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER: NUMBER

SCALE:

PROJECT NUMBER:
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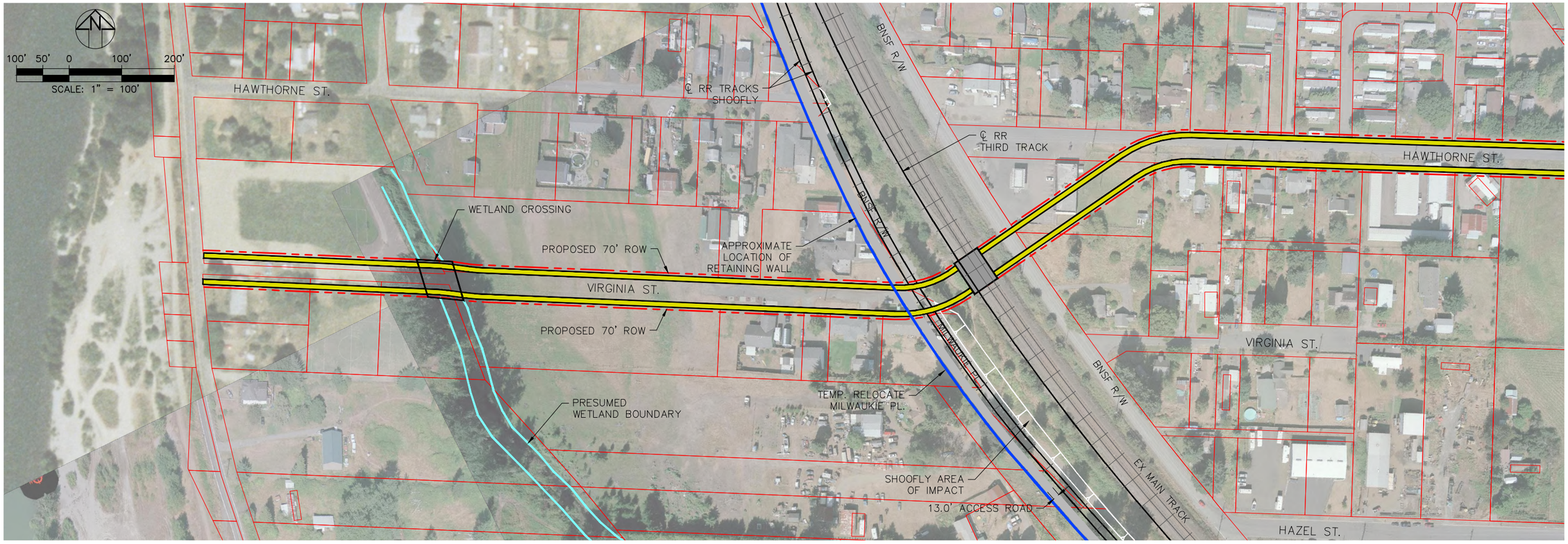

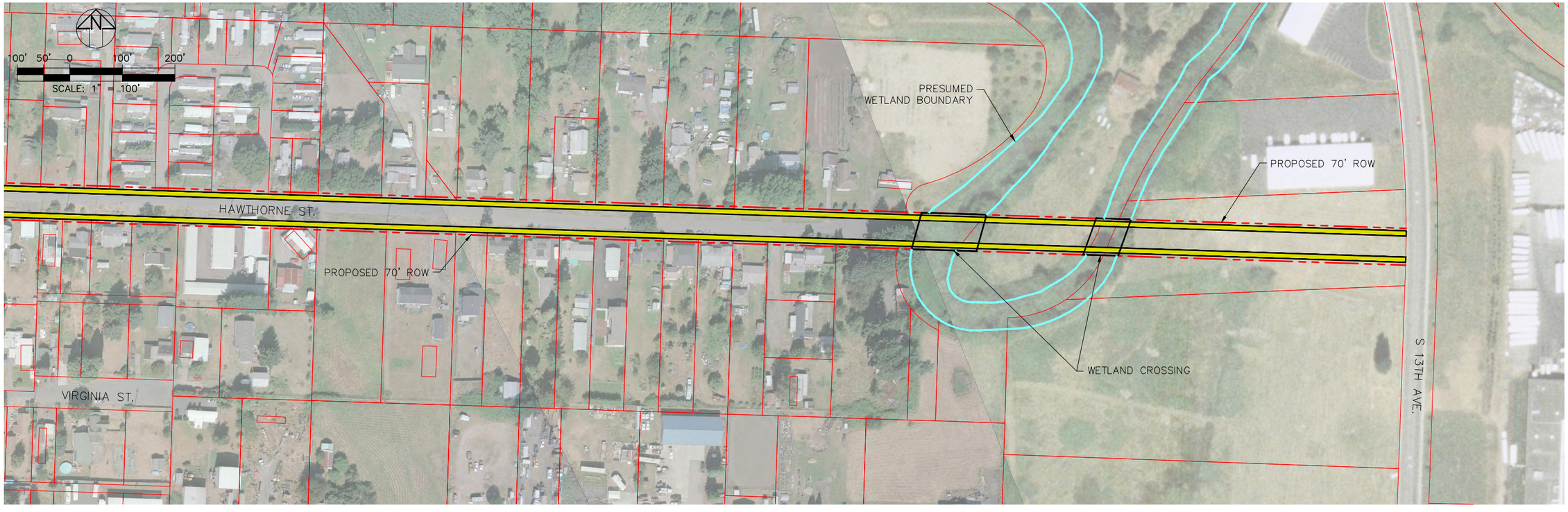

S KELSO RR CROSSING STUDY

OPTION 3 UNDER CROSSING
HAWTHORNE TO VIRGINIA

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland, Oregon 97201
Phone: 503.223.6663

PRELIMINARY CONTENT SUBJECT TO CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
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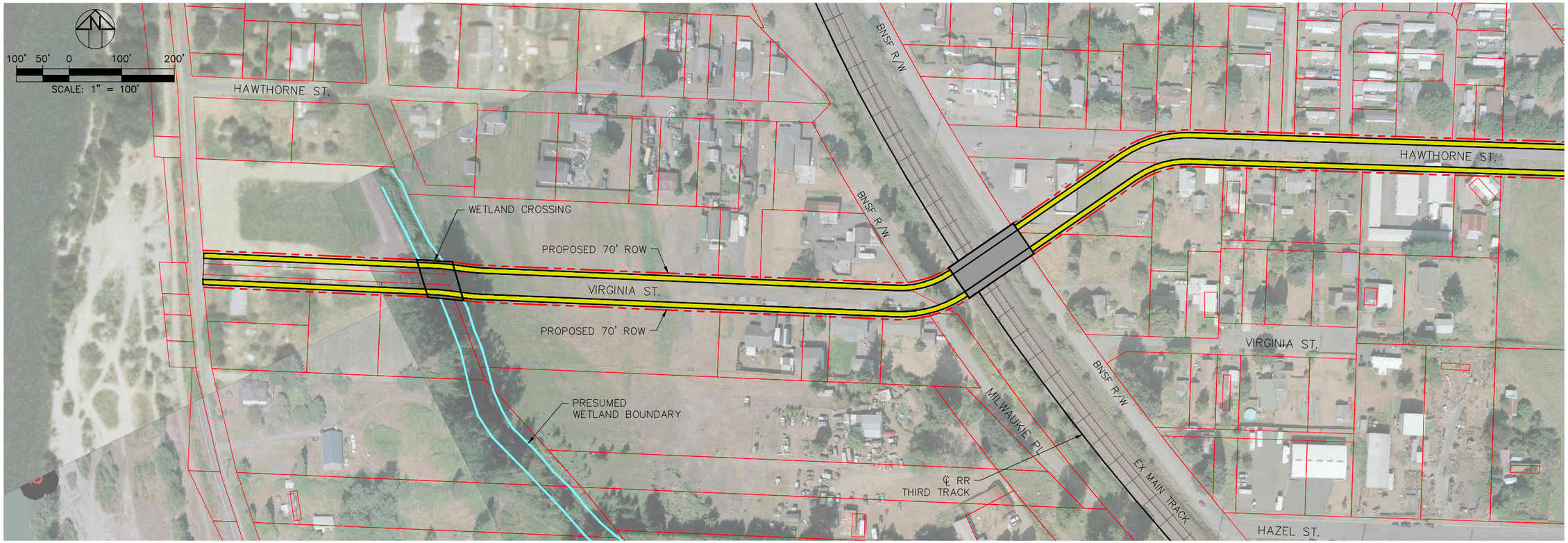

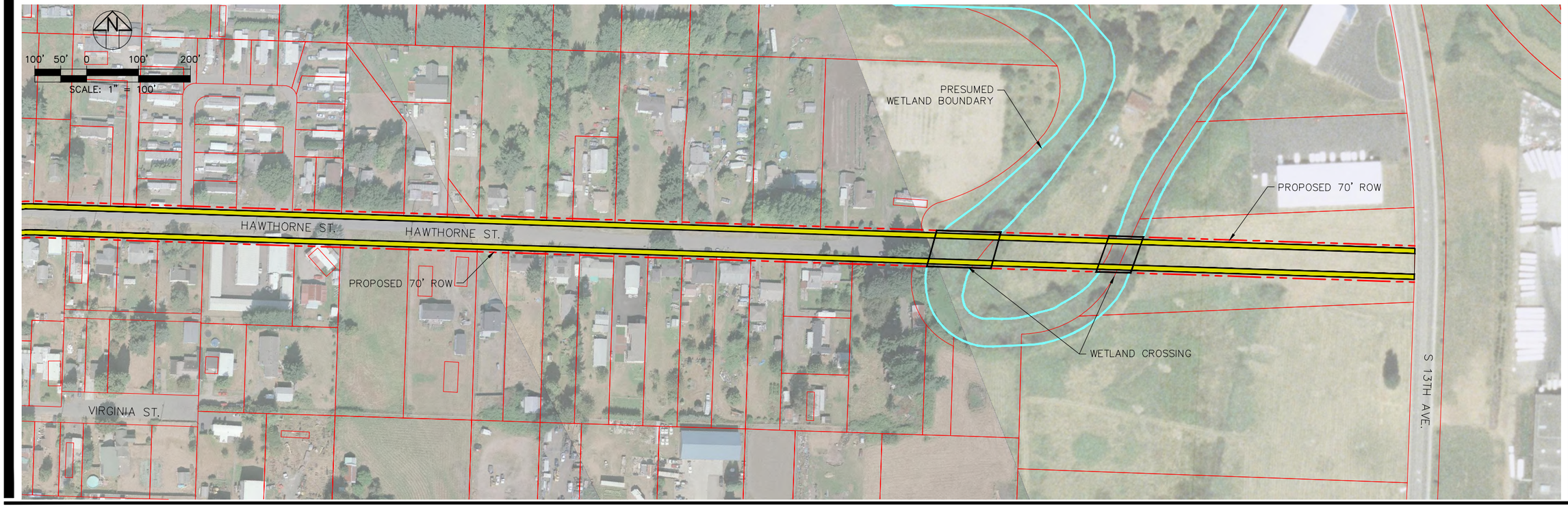

S KELSO RR CROSSING STUDY

OPTION 4 OVER CROSSING
HAWTHORNE TO VIRGINIA

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland, Oregon 97201
Phone: 503.223.6663

PRELIMINARY
CONTENT
SUBJECT TO
CHANGE

REVISIONS:	APPD.

DATE: 3/1/2013
DESIGN: ACE
DRAWN: JEJO
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

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OPINION OF COST ESTIMATE
S Kelso RR Crossing Study *

DAVID EVANS ASSOCIATES

* This estimate covers the proposed RR Crossing project from S River Rd, West of BNSF Railroad, to Hazel St					Option 1: Under Crossing	
Std. Item No.	**Item**	**Unit**	**Unit Cost**		**Quantity**	**Cost**
Section1	**Earthwork**			**Subtotal**		**$ 260,900**
	Clearing and Grubbing	ACRE	$ 4,000		3.2	$ 12,800
	Roadway Excavation Including Haul	C.Y.	$ 9.00		25,300	$ 227,700
	Gravel Borrow Including Haul	C.Y.	$ 12.00		1,700	$ 20,400
Section 2	**Roadway**			**Subtotal**		**$ 595,980**
	Asphalt Concrete Pavement & Base	S.Y.	$ 45		13,244	$ 595,980
Section 3	**Drainage**			**Subtotal**		**$ 2,682,500**
	Pump Station (5000 to 8000 gpm)	L.S.	$ 2,500,000		1	$ 2,500,000
	Inlet	EACH	$ 1,800		23	$ 41,400
	12-inch Pipe	L.F.	$ 60		1,510	$ 90,600
	Infiltration Swale	L.F.	$ 30		1,350	$ 40,500
	Infiltration Basin	L.S.	1		1	$ 10,000
Section 4	**Specialty Items**			**Subtotal**		**$ 2,942,400**
	Retaining Walls, MSE	S.F.	$ 110		0	$ -
	Retaining Walls, Concrete	S.F.	$ 150		19,616	$ 2,942,400
Section 5	**Railroad Shoofly**			**Subtotal**		**$ 14,341,451**
	Earthwork	L.S.	1		1	$ 3,095,851
	Track	L.S.	1		1	$ 5,662,400
	Railroad Structures (Retaining Wall)	L.S.	1		1	$ 1,159,200
	Railroad Signals	L.S.	1		1	$ 4,424,000
Section 6	**Structures**			**Subtotal**		**$ 2,195,100**
	Single Span RR Bridge	S.F.	$ 550		3,816	$ 2,098,800
	Three Span Roadway Bridge	S.F.	$ 300		0	$ -
	Ground Improvement	C.Y.	$ 9		10,700	$ 96,300
	Underpass Structure	L.S.				
Section 7	**Other Items**			**Subtotal**		**$ 1,770,976**
	Surveying	L.S.	1		1	$ 50,000
	Cement Concrete Sidewalk & Base	S.Y.	$ 50		1,263	$ 63,132
	Wetland/Flood Plain Impacts & Mitigation	S.F.	$ 60		20,400	$ 1,224,000
	Traffic Control (5% of Sections 1, 2, 3, 4, 6)	L.S.	1		1	$ 433,844
	Major Item Subtotal					**$ 24,789,300**
	Minor Items and Contingencies				$7,436,790	
	30% of Major Item Subtotal		30%			**$ 32,226,090**
	Mobilization				$3,222,609	
	10% of (Inflated Construction Subtotal)		10%			**$ 35,448,699**
	Sales Tax				$2,800,447	
	7.9% of (Inflated Construction Subtotal + Mob.)		7.9%			**$ 38,249,146**
	Construction Contract Est. Bid Amount					**$ 38,249,000**
	Construction Engineering				$3,824,915	
	10% of (Inflated Con. + Mob. + Tax + Agreements)		10%			**$ 42,074,061**
	Construction Contingencies				$1,682,962	
	4% of (Inflated Con. + Mob. + Tax + Agreements)		4%			**$ 43,757,023**
	Construction Total					**$ 43,757,000**
	Preliminary Engineering		15%			$ 6,563,550
	15% of (Construction Total)					
	Project Total					**$50,320,550**
	Right of Way			**Subtotal**		**$ 683,800**
	Right of Way (Unit Cost TBD)	S.F.	$ 1		683,800	$ 683,800
	Total Project Cost With Right-Of-Way					**$51,004,000**

OPINION OF COST ESTIMATE
S Kelso RR Crossing Study *

DAVID EVANS ASSOCIATES

*** This estimate covers the proposed RR Crossing project from S River Rd, West of BNSF Railroad, to Hazel St**

Std. Item No.	Item	Unit	Unit Cost		Option 2A: Over Crossing Quantity	Option 2A: Over Crossing Cost
Section1	**Earthwork**			**Subtotal**		**$ 841,170**
	Clearing and Grubbing	ACRE	$ 4,000		3.6	$ 14,400
	Roadway Excavation Including Haul	C.Y.	$ 9.00		930	$ 8,370
	Gravel Borrow Including Haul	C.Y.	$ 12.00		68,200	$ 818,400
Section 2	**Roadway**			**Subtotal**		**$ 665,730**
	Asphalt Concrete Pavement & Base	S.Y.	$ 45		14,794	$ 665,730
Section 3	**Drainage**			**Subtotal**		**$ 255,250**
	Pump Station (5000 to 8000 gpm)	L.S.	$ 2,500,000		0	$ -
	Inlet	EACH	$ 1,800		28	$ 50,400
	12-inch Pipe	L.F.	$ 60		2,510	$ 150,600
	Infiltration Swale	L.F.	$ 30		975	$ 29,250
	Infiltration Basin	L.S.	1		1	$ 25,000
Section 4	**Specialty Items**			**Subtotal**		**$ 4,290,000**
	Retaining Walls, MSE	S.F.	$ 110		39,000	$ 4,290,000
	Retaining Walls, Concrete	S.F.	$ 150		0	$ -
Section 5	**Railroad Shoofly**			**Subtotal**		**$ -**
	Earthwork	L.S.	1		0	$ -
	Track	L.S.	1		0	$ -
	Railroad Structures (Retaining Wall)	L.S.	1		0	$ -
	Railroad Signals	L.S.	1		0	$ -
Section 6	**Structures**			**Subtotal**		**$ 3,348,750**
	Single Span RR Bridge	S.F.	$ 550		0	$ -
	Three Span Roadway Bridge	S.F.	$ 300		10,450	$ 3,135,000
	Ground Improvement	C.Y.	$ 9		23,750	$ 213,750
	Underpass Structure	L.S.				
Section 7	**Other Items**			**Subtotal**		**$ 1,840,231**
	Surveying	L.S.	1		1	$ 50,000
	Cement Concrete Sidewalk & Base	S.Y.	$ 50		1,924	$ 96,186
	Wetland/Flood Plain Impacts & Mitigation	S.F.	$ 60		20,400	$ 1,224,000
	Traffic Control (5% of Sections 1, 2, 3, 4, 6)	L.S.	1		1	$ 470,045
	Major Item Subtotal					**$ 11,241,100**
	Minor Items and Contingencies				$3,372,330	
	30% of Major Item Subtotal		30%			**$ 14,613,430**
	Mobilization				$1,461,343	
	10% of (Inflated Construction Subtotal)		10%			**$ 16,074,773**
	Sales Tax				$1,302,057	
	7.9% of (Inflated Construction Subtotal + Mob.)		7.9%			**$ 17,376,830**
	Construction Contract Est. Bid Amount					**$ 17,377,000**
	Construction Engineering				$1,737,683	
	10% of (Inflated Con. + Mob. + Tax + Agreements)		10%			**$ 19,114,513**
	Construction Contingencies				$764,581	
	4% of (Inflated Con. + Mob. + Tax + Agreements)		4%			**$ 19,879,093**
	Construction Total					**$ 19,879,000**
	Preliminary Engineering		15%			$ 2,981,850
	15% of (Construction Total)					
	Project Total					**$22,860,850**
	Right of Way			**Subtotal**		**$ 756,350**
	Right of Way (Unit Cost TBD)	S.F.	$ 1		756,350	$ 756,350
	Total Project Cost With Right-Of-Way					**$23,617,000**

OPINION OF COST ESTIMATE
S Kelso RR Crossing Study *

DAVID EVANS ASSOCIATES

* This estimate covers the proposed RR Crossing project from S River Rd, West of BNSF Railroad, to Hazel St, raise S Pacific Ave					Option 2B: Over Crossing	
Std. Item No.	**Item**	**Unit**	**Unit Cost**		**Quantity**	**Cost**
Section1	**Earthwork**			**Subtotal**		**$ 959,370**
	Clearing and Grubbing	ACRE	$ 4,000		3.0	$ 12,000
	Roadway Excavation Including Haul	C.Y.	$ 9.00		730	$ 6,570
	Gravel Borrow Including Haul	C.Y.	$ 12.00		78,400	$ 940,800
Section 2	**Roadway**			**Subtotal**		**$ 727,560**
	Asphalt Concrete Pavement & Base	S.Y.	$ 45		16,168	$ 727,560
Section 3	**Drainage**			**Subtotal**		**$ 255,250**
	Pump Station (5000 to 8000 gpm)	L.S.	$ 2,500,000		0	$ -
	Inlet	EACH	$ 1,800		28	$ 50,400
	12-inch Pipe	L.F.	$ 60		2,510	$ 150,600
	Infiltration Swale	L.F.	$ 30		975	$ 29,250
	Infiltration Basin	L.S.	1		1	$ 25,000
Section 4	**Specialty Items**			**Subtotal**		**$ 9,795,500**
	Retaining Walls, MSE	S.F.	$ 110		89,050	$ 9,795,500
	Retaining Walls, Concrete	S.F.	$ 150		0	$ -
Section 5	**Railroad Shoofly**			**Subtotal**		**$ -**
	Earthwork	L.S.	1		0	$ -
	Track	L.S.	1		0	$ -
	Railroad Structures (Retaining Wall)	L.S.	1		0	$ -
	Railroad Signals	L.S.	1		0	$ -
Section 6	**Structures**			**Subtotal**		**$ 2,111,250**
	Single Span RR Bridge	S.F.	$ 550		0	$ -
	Two Span Roadway Bridge	S.F.	$ 300		6,325	$ 1,897,500
	Ground Improvement	C.Y.	$ 9		23,750	$ 213,750
	Underpass Structure	L.S.	$ -		0	
Section 7	**Other Items**			**Subtotal**		**$ 2,040,197**
	Surveying	L.S.	1		1	$ 50,000
	Cement Concrete Sidewalk & Base	S.Y.	$ 50		1,475	$ 73,750
	Wetland/Flood Plain Impacts & Mitigation	S.F.	$ 60		20,400	$ 1,224,000
	Traffic Control (5% of Sections 1, 2, 3, 4, 6)	L.S.	1		1	$ 692,447
	Major Item Subtotal					**$ 15,889,100**
	Minor Items and Contingencies				$4,766,730	
	30% of Major Item Subtotal		30%			**$ 20,655,830**
	Mobilization				$2,065,583	
	10% of (Inflated Construction Subtotal)		10%			**$ 22,721,413**
	Sales Tax				$1,840,434	
	7.9% of (Inflated Construction Subtotal + Mob.)		7.9%			**$ 24,561,847**
	Construction Contract Est. Bid Amount					**$ 24,562,000**
	Construction Engineering				$2,456,185	
	10% of (Inflated Con. + Mob. + Tax + Agreements)		10%			**$ 27,018,032**
	Construction Contingencies				$1,080,721	
	4% of (Inflated Con. + Mob. + Tax + Agreements)		4%			**$ 28,098,753**
	Construction Total					**$ 28,099,000**
	Preliminary Engineering		15%			$ 4,214,850
	15% of (Construction Total)					
	Project Total					**$32,313,850**
	Right of Way			**Subtotal**		**$ 756,350**
	Right of Way (Unit Cost TBD)	S.F.	$ 1		756,350	$ 756,350
	Total Project Cost With Right-Of-Way					**$33,070,000**

OPINION OF COST ESTIMATE
S Kelso RR Crossing Study *

DAVID EVANS ASSOCIATES

* This estimate covers the proposed RR Crossing project from S River Rd, West of BNSF Railroad, to Hawthorne St, to 13th Ave					Option 3: Under Crossing	
Std. Item No.	**Item**	**Unit**	**Unit Cost**		**Quantity**	**Cost**
Section1	**Earthwork**			**Subtotal**		**$ 260,900**
	Clearing and Grubbing	ACRE	$ 4,000		3.2	$ 12,800
	Roadway Excavation Including Haul	C.Y.	$ 9.00		25,300	$ 227,700
	Gravel Borrow Including Haul	C.Y.	$ 12.00		1,700	$ 20,400
Section 2	**Roadway**			**Subtotal**		**$ 1,350,000**
	Asphalt Concrete Pavement & Base	S.Y.	$ 45		30,000	$ 1,350,000
Section 3	**Drainage**			**Subtotal**		**$ 2,682,500**
	Pump Station (5000 to 8000 gpm)	L.S.	$ 2,500,000		1	$ 2,500,000
	Inlet	EACH	$ 1,800		23	$ 41,400
	12-inch Pipe	L.F.	$ 60		1,510	$ 90,600
	Infiltration Swale	L.F.	$ 30		1,350	$ 40,500
	Infiltration Basin	L.S.	1		1	$ 10,000
Section 4	**Specialty Items**			**Subtotal**		**$ 2,942,400**
	Retaining Walls, MSE	S.F.	$ 110		0	$ -
	Retaining Walls, Concrete	S.F.	$ 150		19,616	$ 2,942,400
Section 5	**Railroad Shoofly**			**Subtotal**		**$ 14,341,451**
	Earthwork	L.S.	1		1	$ 3,095,851
	Track	L.S.	1		1	$ 5,662,400
	Railroad Structures (Retaining Wall)	L.S.	1		1	$ 1,159,200
	Railroad Signals	L.S.	1		1	$ 4,424,000
Section 6	**Structures**			**Subtotal**		**$ 2,195,100**
	Single Span RR Bridge	S.F.	$ 550		3,816	$ 2,098,800
	Three Span Roadway Bridge	S.F.	$ 300		0	$ -
	Ground Improvement	C.Y.	$ 9		10,700	$ 96,300
	Underpass Structure	L.S.				
Section 7	**Other Items**			**Subtotal**		**$ 3,096,545**
	Surveying	L.S.	1		1	$ 75,000
	Cement Concrete Sidewalk & Base	S.Y.	$ 50		3,000	$ 150,000
	Wetland/Flood Plain Impacts & Mitigation	S.F.	$ 60		40,000	$ 2,400,000
	Traffic Control (5% of Sections 1, 2, 3, 4, 6)	L.S.	1		1	$ 471,545
	Major Item Subtotal					**$ 26,868,900**
	Minor Items and Contingencies				$8,060,670	
	30% of Major Item Subtotal		30%			**$ 34,929,570**
	Mobilization				$3,492,957	
	10% of (Inflated Construction Subtotal)		10%			**$ 38,422,527**
	Sales Tax				$3,035,380	
	7.9% of (Inflated Construction Subtotal + Mob.)		7.9%			**$ 41,457,907**
	Construction Contract Est. Bid Amount					**$ 41,458,000**
	Construction Engineering				$4,145,791	
	10% of (Inflated Con. + Mob. + Tax + Agreements)		10%			**$ 45,603,697**
	Construction Contingencies				$1,824,148	
	4% of (Inflated Con. + Mob. + Tax + Agreements)		4%			**$ 47,427,845**
	Construction Total					**$ 47,428,000**
	Preliminary Engineering		15%			$ 7,114,200
	15% of (Construction Total)					
	Project Total					**$54,542,200**
	Right of Way			**Subtotal**		**$ 1,000,000**
	Right of Way (Unit Cost TBD)	S.F.	$ 1		1,000,000	$ 1,000,000
	Total Project Cost With Right-Of-Way					**$55,542,000**

OPINION OF COST ESTIMATE
S Kelso RR Crossing Study *

DAVID EVANS ASSOCIATES

*** This estimate covers the proposed RR Crossing project from S River Rd, West of BNSF Railroad, to Hawthorne St, to 13th Ave**

Std. Item No.	Item	Unit	Unit Cost		Option 4: Over Crossing Quantity	Option 4: Over Crossing Cost
Section1	**Earthwork**			**Subtotal**		**$ 841,170**
	Clearing and Grubbing	ACRE	$ 4,000		3.6	$ 14,400
	Roadway Excavation Including Haul	C.Y.	$ 9.00		930	$ 8,370
	Gravel Borrow Including Haul	C.Y.	$ 12.00		68,200	$ 818,400
Section 2	**Roadway**			**Subtotal**		**$ 1,350,000**
	Asphalt Concrete Pavement & Base	S.Y.	$ 45		30,000	$ 1,350,000
Section 3	**Drainage**			**Subtotal**		**$ 255,250**
	Pump Station (5000 to 8000 gpm)	L.S.	$ 2,500,000		0	$ -
	Inlet	EACH	$ 1,800		28	$ 50,400
	12-inch Pipe	L.F.	$ 60		2,510	$ 150,600
	Infiltration Swale	L.F.	$ 30		975	$ 29,250
	Infiltration Basin	L.S.	1		1	$ 25,000
Section 4	**Specialty Items**			**Subtotal**		**$ 4,400,000**
	Retaining Walls, MSE	S.F.	$ 110		40,000	$ 4,400,000
	Retaining Walls, Concrete	S.F.	$ 150		0	$ -
Section 5	**Railroad Shoofly**			**Subtotal**		**$ -**
	Earthwork	L.S.	1		0	$ -
	Track	L.S.	1		0	$ -
	Railroad Structures (Retaining Wall)	L.S.	1		0	$ -
	Railroad Signals	L.S.	1		0	$ -
Section 6	**Structures**			**Subtotal**		**$ 3,348,750**
	Single Span RR Bridge	S.F.	$ 550		0	$ -
	Three Span Roadway Bridge	S.F.	$ 300		10,450	$ 3,135,000
	Ground Improvement	C.Y.	$ 9		23,750	$ 213,750
	Underpass Structure	L.S.				
Section 7	**Other Items**			**Subtotal**		**$ 3,184,759**
	Surveying	L.S.	1		1	$ 75,000
	Cement Concrete Sidewalk & Base	S.Y.	$ 50		4,000	$ 200,000
	Wetland/Flood Plain Impacts & Mitigation	S.F.	$ 60		40,000	$ 2,400,000
	Traffic Control (5% of Sections 1, 2, 3, 4, 6)	L.S.	1		1	$ 509,759
	Major Item Subtotal					**$ 13,379,900**
	Minor Items and Contingencies				$4,013,970	
	30% of Major Item Subtotal		30%			**$ 17,393,870**
	Mobilization				$1,739,387	
	10% of (Inflated Construction Subtotal)		10%			**$ 19,133,257**
	Sales Tax				$1,549,794	
	7.9% of (Inflated Construction Subtotal + Mob.)		7.9%			**$ 20,683,051**
	Construction Contract Est. Bid Amount					**$ 20,683,000**
	Construction Engineering				$2,068,305	
	10% of (Inflated Con. + Mob. + Tax + Agreements)		10%			**$ 22,751,356**
	Construction Contingencies				$910,054	
	4% of (Inflated Con. + Mob. + Tax + Agreements)		4%			**$ 23,661,410**
	Construction Total					**$ 23,661,000**
	Preliminary Engineering		15%			$ 3,549,150
	15% of (Construction Total)					
	Project Total					**$27,210,150**
	Right of Way			**Subtotal**		**$ 1,250,000**
	Right of Way (Unit Cost TBD)	S.F.	$ 1		1,250,000	$ 1,250,000
	Total Project Cost With Right-Of-Way					**$28,460,000**

Appendix B

Sensitive Areas and Federal Permitting Requirements (Memoranda)

DAVID EVANS
AND ASSOCIATES INC.

MEMORANDUM

DATE:	April 26, 2012
TO:	Mr. Mike Kardas
FIRM:	City of Kelso
	PO Box 819 203 South Pacific Avenue
	Kelso, WA 98626
FROM:	John Macklin, Biologist
SUBJECT:	**Environmental Sensitive Areas Technical Memorandum**
PROJECT:	KESO0000-0002 – SOUTH KELSO RAILROAD STUDY
COPIES:	Adrian Esteban, Neal Christensen

Introduction and Approach

David Evans and Associates, Inc. (DEA) has performed a preliminary investigation of the South Kelso Railroad Crossing proposed road alignment to identify any features that may be protected by federal, state, or local environmental regulations. Regulations that may potentially apply are discussed in a separate memorandum, also dated April 26, 2012.

Published information sources were reviewed, including the following:

* Cowlitz Area Soil Survey, USDA Soil Conservation Service;

*Cowlitz/Wahkiakum Council of Governments Draft Hazard Mitigation Plan update, April 2011;

*National Wetlands Inventory Kelso WA/OR quadrangle, US Geological Survey 1981

*US Fish and Wildlife Service (USFWS) list of species occurring in Cowlitz County, August 2, 2011;

*Federal Emergency Management Administration (FEMA) map panel 5300330003 E;

*Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Database, 2011;

*Personal communication with Mr. Del Hilger and Mr. Ken Stone of Cowlitz County public works staff regarding site diking and drainage, December 15, 2011 and January 9, 2012.

The site was inspected by DEA biologists and engineers on December 12, 2011.

The project area was defined as a corridor approximately 300 feet wide beginning at Hazel Street and Douglas Street about 300 feet east of South Pacific Avenue, and extending westward along the northern edge of the Three Rivers Golf Course to South River Road. A railroad parallels the west side of North Pacific Avenue along the top of an approximately 12-foot tall berm.

ESRI, ArcGIS Online, USA Topographic Maps, 2011

Study Area Location

N

0 1,500 3,000

Feet

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Site Environmental Conditions

The site is bordered to the west by the Cowlitz River, which is separated from the site by a levee and South River Road. The Coweeman River, a Cowlitz tributary, passes within one mile east of the site. East of South Pacific Avenue, the project area is occupied by residential and commercial development. West of that road and the railroad, the corridor is undeveloped but shows evidence of past activity including an unpaved road, dredge spoils deposits, and an old building foundation. This part of the site is mapped as well-drained sandy soil (Pilchuck fine loamy sand and Newberg fine sandy loam), but appears to be largely underlain by sandy fill material which may have originated as river dredge spoils. A large mound of apparent dredge spoils occupies the area immediately west of South Pacific Avenue and the railroad tracks.

The undeveloped corridor is vegetated largely by non-native pasture grasses including tall fescue (*Schnedonorous phoenix*), and bentgrass (*Agrostis capillaris*), and by the invasive exotic weed species Scots broom (*Cytisus scoparius*) and Armenian blackberry (*Rubus armeniacus*). The site also supports numerous black cottonwood (*Populus balsamifera*) trees and saplings.

The only water or wetland feature identified within the study area was a swale extending north-south, approximately 300 feet east of South River Road. This area was centered on an inundated swale approximately 30 feet wide, with apparent wetland conditions extending up to about 50 feet beyond the swale along both sides. This swale was vegetated by hydrophytic vegetation species including common cattail (*Typha latifolia*), reed canarygrass (*Phalaris arundinacea),* red-twig dogwood (*Cornus sericea*), and black cottonwood. There is a small break in the swale within the study area where the swale is apparently connected by culverts. The Kelso Washington/Oregon quadrangle of the National Wetland Inventory depicts this area as a palustrine emergent seasonal wetland.

An additional feature was identified off-site to the east of the study area, in a location immediately beyond the eastern terminus of Hawthorn Street. A remnant slough associated with the Coweeman River is located here.

The study area, as well as the Hawthorn Street slough, lie within the Cowlitz Drainage Improvement District #3 (CCID 3). It is separated from the Cowlitz River by dikes, and is mapped as Zone X by FEMA, which is described as being "protected from the …. 100-year flood by levee, dike or other structures subject to possible failure or overtopping during larger floods." The study area slough is connected to the river only by two pump stations, one operated by CCID 3 and one operated by the Three Rivers Golf Course. CCID 3 pumps water only during the most severe rainfall events, because the area does not usually collect enough water to require drainage even during the wet season (Hilger pers comm 2011 and Stone pers comm. 2012).

Threatened and Endangered Species

The table below summarizes listed and proposed species that could potentially occur in the project vicinity. The USFWS list of endangered and threatened species in Cowlitz County lists six listed species in the county: bull trout; Columbian white-tailed deer, gray wolf, marbled murrelet, northern spotted owl, and Nelsons checker mallow. Nelson's checker mallow and Columbian white-tailed deer are the only species on this list that have any possible occurrence or suitable habitat in the vicinity. However, they are highly unlikely to occur in the project area because of the high levels of human activity and disturbance of suitable habitat at the site. Nelson's checker-

ESRI, ArcGIS Online, World Imagery

Aerial Photograph

N

0 1,000 2,000

Feet

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mallow is a small flowering herb that occurs on moist, open ground in meadows and occasionally in wooded habitats. The numerous aquatic species that may be present in the Cowlitz River are excluded from the project area by the flood control dike system. The only connection of the on-site slough to the river is the pump station connection, which is impassable. The WDFW priority habitats and species database displays tideflat habitat and presence of several salmon and trout species in the Cowlitz River, but no priority habitats or species within the project area.

Common Name	Scientific Name	Agency with Jurisdiction	Federal /State Status	Occurrence in Project Vicinity	Occurrence in Project Area
Steelhead trout (Lower Columbia River ESU, winter run)	*Oncorhynchus mykiss pop. 33*	NMFS	LT	Cowlitz River	None, connected only by pump station
Chinook salmon	*Oncorhynchus tshawytcha*	NMFS	LT	Cowlitz River	None
Coho salmon	*Oncorhynchus kisutch*	NMFS	LT	Cowlitz River	None
Green sturgeon	*Acipenser medirostrus*	USFWS	LT	Cowlitz River	None
Eulachon	*Thaleichthys pacificus*	USFWS	LT	Cowlitz River	None
Columbian White-Tailed Deer	*Odocoilius virginianus leucurus*	USFWS	LE	None	None
Nelson's Checker Mallow	*Sidalcea nelsoniana*	USFWS	LE	None	None

Conclusion

The project area contains one feature which will be considered environmentally sensitive for regulatory purposes: the central wetland swale. A similar but separate swale is located east of the study area at the east end of Hawthorn Street. No threatened or endangered species or suitable habitat for them, are known to occur on the site. It is likely that the pump station connection to the Cowlitz River is impassable, thus isolating Cowlitz River fish from on-site activities. Additional discussion of regulatory jurisdiction is presented in the accompanying regulatory memorandum.

References

Del Hilger, Cowlitz County Public Works, Personal communication December 2011.

Ken Stone, Cowlitz County Public Works, Personal communication January 2012.

Attachments/Enclosures: Vicinity Map, Aerial Photo

Initials: JDM/dgaf

File Name: P:\K\KESO00000002\0600INFO\0670Reports\0671 Environmental Memos\0671-B Sensitive Areas Memo\Final\2012-04 final_Sensitive Areas Memo.docx

DAVID EVANS AND ASSOCIATES INC.

MEMORANDUM

DATE: April 26, 2012

TO: Mr. Mike Kardas

FIRM: City of Kelso

PO Box 819
203 South Pacific Avenue

Kelso, WA 98626

FROM: John Macklin, Biologist

SUBJECT: **Environmental Regulations Technical Memorandum**

PROJECT: KESO0000-0002 – SOUTH KELSO RAILROAD STUDY

COPIES: Adrian Esteban, Neal Christensen

Several State and Federal level laws will apply to regulate disturbance of any environmental resources that may be present at the South Kelso Railroad Crossing as summarized in Table 1 and discussed below. Local regulations as well as the Washington State Environmental Policy Act (SEPA) and Washington State Shoreline Management Act are discussed separately in a document regarding land use regulations.

USACE Regional General Permit for Clean Water Act Section 404 Permits.

The US Army Corps of Engineers (USACE) has jurisdiction over Waters of the US and all wetlands that are connected to them, and requires a Clean Water Act Section 404 permit for filling within these areas. The slough within the project site is likely to be considered adjacent to the Cowlitz River even though pumping stations are the only connection, because the separation between the waters is a man-made dike. There are no time limitations for review of Section 404 permits, but the USACE typically arrives at a permit decision within about six months if the process is not delayed by the federal Endangered Species Act (ESA) considerations.

Washington Hydraulic Project Approval

Washington's Hydraulic Code regulates any construction activity that uses, diverts, changes, or obstructs the bed or flow of state waters. Washington Department of Fish and Wildlife (WDFW) review a Hydraulic Project Approval (HPA) application for such activities, and are required to respond to take action on complete applications within 45 days.

Although the on-site slough is considered a water of the state, alteration for a road crossing will not likely require an HPA because of its isolation from the Cowlitz River and its lack of fish habitat. This is based on site-specific communication with WDFW (West, pers comm. 2012).

Joint Aquatic Resource Permit Application.

The Joint Aquatic Resource Permit Application (JARPA) is the application form for both the 404 permit and/or the HPA. Copies of the application form, project plans, and resource plans are sent to the USACE and/or WDFW. Application requirements will include the following:

- Wetland delineation and report
- Cultural resources survey
- Phase I environmental site assessment for hazardous materials
- Project plans, at least concept level, with accurate cut, fill, and footprint quantities;
- Alternatives analysis;
- In-water work area isolation plan;
- Compensatory Mitigation Plan for permanent impacts to the waterway and riparian area;
- Site Restoration Plan (for temporary impacts); and
- Sediment and Erosion Control Plan.

Endangered Species Act-Permit Requirements and Species Presence

Projects with federal funding, federal permits, licenses, or approvals, or on federal land require federal Endangered Species Act documentation will be required. If listed species are found to potentially occur on site, a Biological Assessment (BA) will be required of the City. The lead agency (e.g. USACE or Federal Railroad Administration) will submit that document to the National Marine Fisheries Service (NMFS) or US Fish and Wildlife Service (USFWS), which will review it and respond with a Biological Opinion authorizing incidental take and establishing conditions for the project. The time frame for consultation is 135 days following submittal of the BA, although this is not a mandatory limit and is typically far exceeded on many projects, up to review periods of over one year.

If no records or evidence of listed species occurrence is found, and no suitable habitat is present for any listed species that could be present, a finding of "No Effects" can be documented in a brief memo for approval by the lead agency without the lengthy NMFS/USFWS review process.

Based on the site conditions including extensive past filling and current activities, it is unlikely that listed USFWS species will be found to occur on the site. No NMFS species are likely to have any potential to occur because of the lack of a fish-passable connection to the Cowlitz River. It is therefore likely that the project may receive a "no effect" determination.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires analysis and disclosure of potential environmental effects of a proposed federal or state action, including funding or issuance of permits. There are several levels of documentation and the project will require at least the Washington State Department of Transportation (WSDOT) Environmental Classification Summary (ECS) form. Completion of this form will likely require a Phase I environmental site assessment for hazardous materials, cultural resource survey, wetland delineation, and "environmental justice" documentation and outreach (Vance pers comm. 2012). Depending on potential impacts disclosed by the ECS, public comment, and whether the lead federal agency is Federal Railroad Administration (FRA) or Federal Highway Administration (FHWA) the project may also require an environmental assessment (EA) document.

National Historic Preservation Act

Projects with federal funding, federal permits, licenses, or approvals, or on federal land must comply with Section 106 of the National Historic Preservation Act (NHPA). A cultural resources survey of the site will be required. Washington State Department of Transportation (WSDOT) Highways and Local Programs division will assist the City in the required Section 106 consultation with affected Indian tribes and with the State Historic Preservation Office (SHPO) on behalf of the FHWA

Table 1: Environmental Regulations Potentially Affecting Railroad Crossing Construction

Regulation	Jurisdictional Agency	Project Activity Regulated	Typical Agency Review Timeframe	Notes
Clean Water Act Section 404	U.S. Army Corps of Engineers (USACE)	Earthwork within streams or wetlands.	Six months to one year.	Will be required for any fill within slough.
Washington Hydraulic Project Approval (HPA)	Washington Department of Fish and Wildlife (WDFW)	Culvert replacement or other work in stream channels.	45 days from application.	Will not be required for this project
Federal Endangered Species Act (ESA)	National Marine Fisheries Service (NMFS); US Fish and Wildlife Service (USFWS)	Any action potentially affecting listed species.	135 days or more if listed species present, concurrent with 404 and HPA if not.	There is little potential for listed species to occur at the site.

Regulation	Jurisdictional Agency	Project Activity Regulated	Typical Agency Review Timeframe	Notes
Migratory Bird Treaty Act (MBTA)	U.S. Fish and Wildlife Service (USFWS)	Vegetation removal; regulates timing to protect active bird nests.	Compliance does not require permitting, but clearing season limited to fall and winter.	Applies to "federal actions" including projects requiring federal permits.
National Environmental Policy Act (NEPA)	Federal Railroad Administration will likely be designated as lead agency	Overall project.	Likely up to six months.	Requires WSDOT Environmental Classification Summary form.
National Historic Preservation Act	Federal Highway Administration	Earthwork.	Up to six months.	Requires Cultural Resources Survey

Summary of Required Site Studies

Site-specific studies required for compliance with the regulations discussed above will include the following:

- Wetland and waters delineation;
- Cultural resources survey;
- Phase I hazardous materials site assessment and potentially Phase 2 assessment depending on findings;
- Environmental Justice assessment and public outreach; and

References

Melanie Vance, WDOT Highways and Local Programs Environmental Engineer, Personal communication January 2012;

Steve West, WDFW Area Habitat Biologist, Personal communication January 2012.

Attachments/Enclosures: vicinity map

Initials: JDM/dgaf

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ESRI, ArcGIS Online, USA Topographic Maps, 2011

Study Area Location

N

0 1,500 3,000

Feet

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Appendix C

Geotechnical Report

GRI
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W1081 GEOTECHNICAL RPT

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DRAFT

Attention: Neal Christensen, PE

SUBJECT: Preliminary Geotechnical Investigation
South Kelso Railroad Crossing
Kelso, Washington

At your request, GRI has completed a preliminary geotechnical investigation for the above-referenced project in Kelso, Washington. The general location of the site is shown on the Vicinity Map, Figure 1. The investigation was completed to evaluate subsurface conditions near the proposed railroad crossing and develop preliminary design recommendations to help evaluate railroad undercrossing and overcrossing alternatives for Hazel Street. Our investigation included a review of available geologic and geotechnical information for the site, an exploration boring, laboratory testing, and preliminary engineering analyses. This report describes the work accomplished and provides our preliminary conclusions and recommendations for evaluation of the costs and feasibility of the overcrossing and undercrossing alternatives.

The following documents were reviewed for geotechnical information:

> Agra Earth and Environmental, March 27, 1998, Draft Geotechnical Investigation and Report, Proposed Allen Street Bridge Replacement Project, Bridge Substructure Report, Kelso, Washington; prepared for Entranco Engineers
>
> Washington State Department of Transportation (WSDOT), September 2009, Geotechnical Data Report, SR-5/SR-432 Talley Way Interchange, XL-2963, MP 35.8 to MP 37.5
>
> WSDOT, February 12, 2007, SR-432, MS-5622, SR-432 Longview Industrial Area Highway and Rail Realignment, Preliminary Geotechnical Engineering Recommendations

PROJECT DESCRIPTION

The preliminary phase of the project involves evaluating a preferred alternative for the realignment and reconstruction of Hazel Street to carry vehicular traffic and pedestrians either over or under the BNSF north-south mainline tracks in Kelso. The rail corridor contains two sets of tracks. The new crossing will supplement an existing at-grade railroad crossing along South River Road approximately 3,000 ft north of the Hazel Street crossing. The Site Plans, Figures 2 and 3, show the proposed location of the overcrossing and undercrossing alternative, respectively, and additional improvements associated with the alternatives.

With both alternatives, Hazel Street will be realigned in a southwesterly direction near South Pacific Avenue. Hazel Street will then extend across the existing railroad embankment to connect with South River Road, a distance of about 3,250 ft.

The overcrossing alternative includes a bridge that will span the existing rail tracks and will likely be a three-span, 70-ft-wide structure with a length of about 168 ft. Approach fills near the bridge will likely be up to 21 ft thick and 70 ft wide and retained by mechanically stabilized earth (MSE) retaining walls. Approach fills may also be constructed as a sloped embankment where sufficient area is available for this configuration. Axial loads for the bridge abutments and intermediate piers are not known at this time. Lateral and uplift loads are also not known at this time and were not considered for this preliminary investigation.

To allow the realignment of Hazel Street beneath the railroad tracks for the undercrossing alternative, existing grades will be lowered between 10 and 14 ft near the railroad crossing to elevations ranging from about 6 to 10 ft. The roadway grade of South Pacific Avenue at the planned intersection with Hazel Street will also be lowered approximately 9 ft to about elevation 11 ft. Retaining walls, or cut slopes where sufficient area is available, will be required within about 400 ft of the proposed railroad bridge. The bridge for the undercrossing alternative will be either one or two spans, 70 to 92 ft long, and 55 ft wide. To temporarily support two railroad tracks and a vehicle access road during construction of the undercrossing, a temporary shoofly embankment up to 14 ft high, 50 ft wide at the top, and approximately 3,800 ft long will be constructed west of the existing tracks. The shoofly embankment fills will be supported by retaining walls or 2H:1V sloped embankments where sufficient area is available.

Based on discussions with the project team, we understand the project will be designed in accordance with the 2011 WSDOT Geotechnical Design Manual M46-03 (GDM) and the AASHTO LRFD Bridge Design Specifications (BDS) (5th Edition) with 2010 Interim Revisions (AASHTO LRFD-BDS).

SITE CONDITIONS

The majority of the site is relatively flat at approximately elevation 20 ft. An elevated berm that supports two railroad tracks at about elevation 33 ft bisects the site in an approximately northwest to southeast alignment. The berm is approximately 27 ft wide at the top and has side slopes of approximately 2H:1V. Asphaltic-concrete (AC) roads and several homes and businesses are located northwest and east of the planned rail crossing. A gravel access road parallels the west side of the railroad tracks south of the site. Mature trees are located west and northwest of the planned crossing. Three Rivers Golf Course is directly south/southwest of the site, and the Cowlitz River is approximately 2,150 ft west of the planned crossing.

GEOLOGY

The site is underlain by alluvium deposited by floodwaters of the Cowlitz River. The near-surface deposits commonly consist of sand and silt, which are underlain at depth by gravel. The above-listed geotechnical documents indicate surficial silt is underlain by sand and gravel at locations near the project site.

SUBSURFACE CONDITIONS

General

Subsurface materials and conditions at the site were investigated on November 3, 2011, with one boring, designated B-1. The boring was advanced to a depth of 101.5 ft at the approximate location shown on

Figures 2 and 3. Two borings were originally scheduled to be drilled for this investigation; however, due to site access limitations and based on discussions with the design team, the location of boring B-1 was moved from its preferred location at the planned crossing, and a second boring was not completed. The field and laboratory testing programs completed for this project are described in Appendix A. A log of boring B-1 is provided on Figure 1A. The terms used to describe the soils encountered in the boring are defined in Table 1A.

Soils

The boring encountered a 3-in.-thick layer of AC pavement over 10 in. of crushed rock base course (CRB) at the ground surface. Sand was encountered beneath the CRB and extends to the bottom of the boring at 101.5 ft. The sand is gray, fine to coarse grained, and contains a variable silt content ranging from a trace of silt to silty. A trace to some gravel was encountered from between a depth of 7.5 and 58 ft. Layers of silt about 1 to 2 in. thick were observed at depths of 1.1 and 60 ft. Scattered wood debris was encountered between 58 and 61 ft. N-values of 5 to 28 blows/ft indicate the relative density of the sand varies from loose to medium dense and is generally medium dense. The natural moisture content of the sand ranges from about 5 to 35%.

Groundwater

Upon completion of drilling, a standpipe was placed in boring B-1 to permit measurement of the groundwater level. Groundwater was measured at depths of 10.6 and 11.4 ft on December 1 and December 21, 2011, respectively. Groundwater levels at the site will fluctuate in response to precipitation and the level of the nearby Cowlitz River and may approach the ground surface during periods of heavy precipitation and/or extended flood levels in the Cowlitz River.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

General

The boring completed for this investigation is located about 700 ft north of the planned rail crossing and disclosed 100 ft of alluvial sand. Our studies indicate the sand beneath the water table will liquefy to a depth of about 80 ft during a design-level earthquake. Liquefaction would result in loss of soil strength and significant deformation of the ground surface at the abutments and beneath embankments and retaining walls. Ground improvement will be required to limit deformation and mitigate the risk of potential collapse of portions of the retained embankments and bridge approaches.

Due to the risk of liquefaction, foundation support for bridges will likely be provided by deep foundations, such as driven piles, or spread footings in conjunction with ground improvement.

Groundwater levels at the site will fluctuate in response to precipitation and levels in the nearby Cowlitz River. The planned roadway elevation of the undercrossing alternative will be below the groundwater level for significant portions of the year. The relatively clean sand encountered in the boring have the potential to yield relatively large quantities of water; therefore, a permanent dewatering and pumping station will be needed to lower the groundwater level below the roadway elevation.

Although not encountered in the boring completed for this project, our experience in the area and review of available geotechnical information for other nearby sites indicate fine-grained, highly compressible silt soils are common in this area. Based on the distance of boring B-1 from the planned crossing and the

variability in soil conditions encountered at other nearby sites, additional explorations at the planned crossing should be completed to evaluate the site-specific subsurface conditions. If fine-grained soils are encountered, design considerations, such as long-term settlement, may be significant.

The following sections of this report provide our preliminary conclusions and recommendations for design and construction of the bridge foundations, retained fills, and related earthwork. Separate discussions are provided for design considerations that are significantly different for the overcrossing and undercrossing alternative.

Site Preparation and Grading

Both the overcrossing and undercrossing alternatives will involve a significant amount of earthwork and grading. The ground surface within the limits of the proposed improvements should be stripped of vegetation, surface organics, and loose surface soils. Areas of grass and weeds should generally be stripped to a depth of about 4 to 6 in. Greater or lesser amounts of stripping may be required locally. The resulting subgrade should be observed by a qualified geotechnical engineer. Areas of soft subgrade, unsuitable fill, or otherwise unsuitable materials should be overexcavated to firm soil and backfilled with structural fill.

The site is surfaced with sand or AC pavement. These materials will generally provide a good working surface; however, the contractor will need to use care during wet conditions to avoid disturbing and loosening the subgrade. The exposed sand subgrade should be moisture conditioned and compacted to at least 95% of the maximum dry density as determined by ASTM D 698 immediately prior to fill placement.

Temporary construction slopes should be cut no steeper than 1H:1V. Permanent cut and fill slopes should be no steeper than 2H:1V.

Structural Fill

On-site or imported soils that are free of organics and other deleterious materials are suitable for use in constructing structural fills such as the approach fills. Silty soils are sensitive to moisture content and can be placed and adequately compacted only during the dry, summer months. For construction during the wet, winter and spring months, fills should be constructed using imported granular materials that are relatively clean. Structural fills should be compacted to at least 95% of the maximum dry density as determined by ASTM D 698. Pieces of rock, concrete, etc., larger than about 6 in. should be removed from the fill prior to compaction.

Seismic Considerations

General: Overcrossing Alternative. The seismic considerations for the overcrossing alternative were evaluated using the GDM and the AASHTO LRFD-BDS. The earthquake-induced peak bedrock acceleration and spectral response accelerations for the site are based on an approximate 1,000-year return interval seismic event (probability of exceedance of 7% in 75 years). The spectral coefficients are selected based on the site latitude and longitude of 46.13° N and 122.91° W, respectively. The spectral response accelerations for the site, S_s and S_1, corresponding to periods of 0.2 and 1.0 second, are approximately 0.604 and 0.235 g, respectively. The corresponding earthquake-induced peak bedrock acceleration is 0.258 g. The site response effects can be determined from site factors, F_{pga}, F_a, and F_v, based on the AASHTO LRFD-BDS site classification. Based on site conditions, we recommend using Site Class D soil profile factors for design of the bridges.

General: Undercrossing Alternative. As discussed with DEA, the site response for the undercrossing alternative was evaluated based on the design considerations required by BNSF, which include consideration of three limit states. The performance at these limit states are evaluated at 100-, 475-, and 2,400-year hazard levels intervals. Performance criteria of the structure for the three hazard levels are discussed in the Stability of Existing Railroad Embankments for Undercrossing Alternative section of the report.

Liquefaction. Liquefaction occurs when saturated, loose to medium dense sand and soft to medium stiff, low-plasticity silt are subject to strong ground shaking during an earthquake, which can result in a rise in the pore water pressure within these types of soils. If the pore water pressure rises to a level that approaches the total weight of the overlying soil column, the soils begin to behave and deform as a viscous liquid. As soil strength is lost in the liquefiable layers, there is an increased risk of settlement and loss of some bearing capacity.

The potential for liquefaction at the location of boring B-1 was evaluated with the aid of the computer software LiquefyPro, a seismically induced liquefaction and settlement analysis software developed by CivilTech Corporation. For the purpose of liquefaction studies, we have assumed the water table is at elevation +15 ft based on our experience in the area. We have selected a magnitude M7.0 earthquake and Site Class D adjusted peak ground acceleration of 0.33 g to evaluate the 1,000-year hazard level. The output from LiquefyPro indicates the loose to medium dense sand below the groundwater level could liquefy to depths of up to 80 ft. We estimate the maximum liquefaction-induced settlement at the site during a design-level earthquake could be about 1.5 ft.

Other Seismic Considerations. Based on subsurface conditions, topography, and site location, it is our opinion the risk of earthquake-induced slope instability and lateral spreading at the site is low, and the risk of seiches or tsunami is absent. There are no active faults mapped on the site, and the risk of ground rupture is low, unless occurring on a previously unknown or unmapped fault.

Foundation Support

The factored loads on the proposed bridge piers and abutments are not known at this time. Our studies indicate that due to the risk of liquefaction at this site, the abutments and intermediate bents can be supported by spread footings if ground improvement is completed or on deep foundations. Based on discussions with DEA, our recommendations for deep foundation have focused on driven pipe piles; however, drilled shafts could also be considered during final design.

Driven Pipe Piles. DEA has indicated that for preliminary design purposes, PP24x0.50-in. steel pipe piles are being considered for support of the abutments and intermediate bents. We have assumed the abutment piles will be driven following placement of the permanent and temporary surcharge fills; this is usually accomplished by installing CMP sleeves through the MSE fill for subsequent driving of piles.

We have evaluated the nominal resistance of pipe piles driven open-end for the strength (static) and extreme limit states (seismic). Open-end pipe piles will develop their supporting capacity from skin friction. As discussed previously, the loose to medium dense sand to a depth of 80 ft could liquefy during a design-level earthquake and induce significant ground settlement. Settlement due to liquefaction will induce downdrag, or negative skin friction, on the piles. In this regard, the nominal resistance for the

extreme limit state will be reduced by downdrag forces due to liquefaction-induced settlement if ground improvement is not completed.

We have assumed that deep ground improvement to a depth of 80 ft will be used at the bridge abutments to limit the potential for liquefaction-induced settlement and minimize downdrag loads on the abutment piles. For driven piles at the abutments with full-depth ground improvement, downdrag is negligible, and the nominal resistance from the strength limit state is appropriate for use in the extreme limit state design. The estimated nominal pile capacities, resistance factors, estimated downdrag loads, and downdrag load factor are summarized in the following table.

24-in.-diameter Pipe Piles	Embedment, ft	Strength Limit State	Extreme Limit State [3]
Nominal Resistance, Rn (Compression)	100	640 kips	280 kips
	110	685 kips	325 kips
	120	730 kips	370 kips
Resistance Factor, ϕ		See note [1]	1.0
Liquefaction-Induced Downdrag Load[2]			150 kips [2]
Downdrag Load Factor, γ			1.1

Notes: 1) A resistance factor of 0.4 is appropriate when the wave equation is used to determine terminal driving criteria. A resistance factor of 0.65 is appropriate when the Pile Driving Analyzer (PDA) is used to evaluate the terminal driving resistance criteria.

2) The liquefaction-induced downdrag load is applicable only for piles in areas where ground improvement is not completed.

3) Assumes ground improvement is not completed; liquefaction occurs.

For the strength limit state, we anticipate settlement of driven steel pipe piles will be limited to the elastic shortening of the pile.

Spread Footings with Ground Improvement. Since full-depth ground improvement is being considered at the bridge abutment for the driven pipe pile foundation option, we have also considered founding the bridge abutments on spread footings with full-depth ground improvement. Spread footings should be analyzed for bearing resistance in the strength and service limit states and for overall stability in the service and extreme limit states. Foundation loads and footing widths are not known at this time. However for preliminary design, preliminary capacities were estimated based on an assumed 5-ft-wide continuous footing. A maximum nominal bearing resistance of 12 ksf was determined for the strength and extreme limit states and a maximum nominal bearing resistance of 5 ksf was estimated for the service limit state.

The AASHTO LRFD BDS recommended resistance factors for footing design are summarized in the table below.

RESISTANCE FACTORS FOR SPREAD FOOTING DESIGN

	Spread Footing Resistance Factors		
	Strength I-V	Service I-IV	Extreme I (EQ)
Bearing Resistance:	0.45	1.00	0.90
Sliding Resistance (Cast-in-Place Concrete):	0.80	1.00	0.90
Passive Component of Sliding Resistance:	0.50	1.00	1.00

Ground Improvement

Several ground improvement alternatives, including vibro compaction and stone columns, were considered for embankment stability and to mitigate seismically induced settlement. Vibro compaction is a ground improvement technique that densifies clean, granular soils, such as clean sand, using a vibratory probe. The probe is vibrated and jetted into the ground until reaching the bottom of the improvement zone. The soils are densified by the vibratory process as the probed is removed. Stone columns are similar to vibro compaction, except aggregate is added to the void created by the probe after reaching the bottom of the treatment zone. The aggregate is densified by lowering the probe into the aggregate in small lifts until reaching the ground surface creating columns of aggregate. Stone columns are typically used in sand that contains a significant portion of fine-grained soils (silt or clay) or low-plasticity, fine-grained soils.

Vibro compaction is most effective in sands with fines contents of less than 15%, and stone columns are more effective for soils with a fines content greater than 15%. Due to the relatively low fines content, typically less than 15%, in boring B-1, the most appropriate and cost-effective ground improvement alternative will likely be vibro compaction.

Additional ground improvement recommendations are provided for the overcrossing and undercrossing.

MSE Walls

General. MSE retaining walls should be designed in conformance with the requirements set forth in Section 15.5.3 of the WSDOT GDM. In our opinion, granular backfill such as gravel borrow conforming to the WSDOT Standard Specifications for Construction M41-10 (WSDOT SSC) should be specified for MSE wall backfill. MSE walls should have a minimum 24-in.-wide zone of free-draining granular material conforming to WSDOT SSC Gravel Backfill for Drains and should be provided with a perforated drain pipe or weep holes (if applicable to the wall type) at the bottom of the backfill. We recommend MSE walls should be embedded at least 2 ft below the finished ground surface.

Design lateral earth pressures for retaining walls depend on the type of construction, i.e., the ability of the wall to yield. Possible conditions are: 1) a wall that is laterally supported at its base and/or top and therefore is unable to yield to the active state, and 2) a retaining wall that yields to the active state by tilting about its base.

Typical MSE walls are yielding walls. However, back-to-back MSE walls with continuous reinforcement between the wall faces may not yield sufficiently to develop the active state. The lateral earth pressure for yielding and non-yielding walls may be computed on the basis of an equivalent fluid unit weight of 35 and 50 pcf, respectively. These earth pressures assume the wall backfill is completely drained and horizontal.

Additional lateral loads due to seismic forces on the MSE walls depend on the final design configuration of the reinforcement and should be evaluated based on the methods discussed in the 2010 WSDOT GDM Sections 15.4.3 and 15.4.10, and the current AASHTO BDS.

In accordance with Article 3.11.6 in the AASHTO LRFD BDS, MSE walls should be designed for the possible presence of construction equipment loads immediately behind the wall. Construction loads can be taken into account by applying an appropriate surcharge live load to the ground surface behind the wall. Since this is a temporary construction load, seismic loads should not be considered for this load case.

Seismically Induced Settlement of MSE Walls with Ground Improvement. Ground improvement will significantly reduce seismically induced settlement in the treated depths, but will not reduce the amount of settlement at the ground surface due to liquefaction of soils beneath the treated zone. For preliminary purposes, we recommend assuming that settlement will not occur in treated soils, and the liquefaction-induced settlement can be calculated as a proportion of the remaining untreated soils. For example, the estimated liquefaction-induced settlement of 1.5 ft based on liquefiable soils to a depth of 80 ft will be reduced by about 75% in areas modified by ground improvement to a depth of 60 ft.

Stability of MSE Wall Abutments for Overcrossing Alternative. As discussed previously, fills up to 21 ft thick will be constructed for the overcrossing alternative bridge approach fills. Due to space constraints, most of the fills will be retained with MSE walls. Where space permits and the fills are not as thick, standard sloped embankment fills will be constructed. Settlements under static conditions should occur as the fills are constructed, provided fine-grained soils are not present. Liquefaction could induce large deformations of the fills and MSE walls, as well as cause failure of portions of the retained fills.

The global stability of the proposed approach fills was evaluated on a preliminary basis for static and seismic conditions. To assist in our evaluation of overall stability of the embankment, two-dimensional models were developed to analyze the embankment cross sections. Basic inputs for the model included existing topography, the embankment configuration provided by DEA, the subsurface profile disclosed by our investigation, and the material properties determined by our laboratory testing program. The two-dimensional models were evaluated using the SLOPE/W program (version 6.22). The program computes the factor of safety (FS) based on the input parameters. We chose to calculate the factor of safety against failure using Spencer's method of slices, since experience suggests that method closely models the performance in the field.

A 21-ft-tall MSE wall was modeled as a surcharge with total unit weight, γ, of 130 pcf. The unit weight of all sand layers was chosen as 115 pcf, and the groundwater was assumed to occur 5 ft below the ground surface. For static conditions, effective angles of internal friction, ϕ', of 32° and 35° were assumed for depths above and below a depth of 10 ft, respectively. For seismic analyses, liquefiable soils below the groundwater table to a depth of 80 ft were modeled using a residual undrained shear strength of 300 psf and total unit weight, γ, of 115 pcf. These analyses were completed without an additional pseudostatic seismic coefficient during liquefied soil conditions.

The calculated static factor of safety for this 21-ft-tall wall configuration is over 2, which exceeds the minimum static FS of 1.3 for non-critical structures and 1.5 for critical structures as recommended in the WSDOT GDM. For the seismic case, our analysis indicates the factor of safety for the global stability of the 21-ft-tall wall is about 0.6. Seismic factors of safety significantly less than 1.0 indicate a high risk of large deformations and failure of large portions of the approach fill during the design earthquake. In our opinion, a FS of 0.6 indicates large deformations of the MSE approach walls will likely occur.

To limit deformation during the design-level earthquake, ground improvement of the soils underlying the embankments was considered. A series of slope stability analyses were completed to evaluate a preliminary embankment footprint and depth of ground improvement that would increase the seismic factor of safety to an acceptable level. These analyses assumed an effective angle of internal friction of 35° and total unit weight of 120 pcf for improved soils. The analyses indicate that ground improvement is

needed to a depth of about 60 ft and extending at least 10 ft beyond the edges of the embankment to provide a factor of safety of about 1.2 for the seismic case.

Groundwater Management for Undercrossing Alternative

Depending on the type of bridge used to support railroad traffic as part of the undercrossing alternative, the new roadway surface for Hazel Street and South Pacific Avenue will be at about elevation 6 ft and extend up to 15 ft below existing grades. Based on the results of this investigation and our experience with other nearby projects, it should be assumed that the groundwater level could approach the existing ground surface during periods of heavy precipitation and/or extended flood levels in the Cowlitz River and should be assumed for planning purposes to be above the bottom of excavation during construction of the undercrossing. In this regard, extensive permanent dewatering will be required for the undercrossing. Boring B-1 encountered relatively clean sand and these clean, granular soils have the potential to yield large quantities of water. Based on the recent groundwater level measurements, a dewatering system will also be needed during construction.

The depth of the excavation will significantly affect the design and cost of the dewatering and shoring at this site. Based on our experience with other deep excavations that extended into relatively clean sand soils, we anticipate dewatering with a series of shallow sumps will be ineffective for management of groundwater and maintaining subgrade stability. Therefore, pumping from a system of deeper dewatering wells will likely be necessary to draw down and maintain the groundwater level below the planned bottom of the excavation during portions of the year. The system of dewatering wells will need to be operated during the design life of the undercrossing and may likely require a backup power system to maintain stability of the improvements during a flood event.

Operation of a long-term dewatering system could affect groundwater levels near the site. If the undercrossing alternative is considered further, additional investigation, including a pump test, should be completed to evaluate aquifer properties, potential pumping volumes, and the potential impacts of nearby residential domestic wells.

Embedded Structures for Undercrossing Alternative

Lateral Earth Pressures. Permanent retaining walls will be required for the undercrossing alternative. Design lateral earth pressures depend on the drainage condition provided behind the wall and the ability of the wall to yield. The walls should be designed to resist lateral earth pressures that vary as a result of groundwater conditions behind the wall. Assuming the retaining walls will be fully drained, as discussed in the Groundwater Management section of this report, and fully restrained by the railroad bridge, i.e., a rigid non-yielding wall, we recommend designing the walls to resist an equivalent fluid pressure of 55H.

Cantilever walls that are free to rotate and develop active earth pressures can be designed to resist an equivalent weight of 35H. This earth pressure assumes the wall will be fully drained. Surcharge loads should be added to the pressures recommended above and can be estimated using the guidelines provided on Figure 4. If the restrained and unrestrained walls retain a sloping backfill of 2H:1V, the equivalent fluid weights should be modified to 80 and 55 pcf, respectively. Equivalent fluid unit weights for intermediate slope values can be interpolated from the above recommendations. These earth pressures assume the wall backfill is completely drained. Additional surcharge pressures for train loading should also be considered during final design.

For restrained walls, we recommend using an inverse triangular distribution of 15H to account for seismic earth pressures, with the resultant applied at 0.6H from the base of the wall. If walls are free to rotate in the active condition, the seismic earth pressures can be reduced to 10H. The lateral force induced by an earthquake is an additional force to the lateral earth pressures acting on the wall during static conditions.

Drainage for walls should be provided by a perforated drain pipe located at the bottom of the backfill that flows to the deeper pumping system. Wall backfill should consist of clean, granular structural fill material compacted to about 95% of the maximum dry density determined by ASTM D 698. A 2-ft-thick blanket of open-graded drain rock with less than about 2% passing the No. 200 sieve (washed analysis) should be placed against the wall. Overcompaction of backfill behind the walls should be avoided. Heavy compactors and large pieces of construction equipment should not operate within 4 ft of any embedded walls.

Stability of Existing Railroad Embankment for Undercrossing Alternative

The undercrossing alternative involves a new railroad bridge to support the tracks over the undercrossing and retaining walls up to 1,100 ft long to support the railroad embankment cut slopes along South Pacific Avenue. Discussions with DEA have indicated BNSF will require three levels of earthquake loading conditions that must be addressed as part of any improvements that directly affect the existing railroad and proposed structures. These limit states are 1) Serviceability Limit State, in which the structure shall not suffer any permanent deformation due to deformations or liquefaction of the foundation soil; 2) Ultimate Limit State, in which the structure shall not suffer any damage which threatens the overall integrity of the bridge due to deformation or liquefaction of the foundation soil; and 3) Survivability Limit State, in which extensive structural damage, short of bridge collapse, may be allowed. Failures of the foundation soil shall not cause major changes in the geometry of the bridge. Depending on the importance and the replacement value of a bridge, BNSF may allow irreparable damage for the survivability limit state and decide to rebuild.

The global stability of the existing railroad embankment was evaluated for seismic conditions to evaluate whether ground improvement is necessary beneath embankments supported by planned retaining walls or other areas of improvement. The existing railroad embankment was modeled similar to the MSE Approach Fill Stability section of this report. Our cross section assumed a 14-ft-tall embankment with 2H:1V side slopes. The embankment was modeled assuming a material having total unit weight, γ, of 130 pcf and effective angle of internal friction, ϕ', of 32°. All other soil layers were modeled consistent with the MSE Approach Fill Stability section of this report.

With liquefaction occurring to a depth of 80 ft, the factor of safety of the existing embankment is about 0.95. Seismic factors of safety less than 1.0 indicate a risk of slope deformation and failure of the embankment.

To limit the risk of seismically induced embankment failures within the footprint of proposed improvements, varying depths and extents of ground improvement were modeled. Similar to the analyses for the overcrossing, improved soils were modeled assuming an effective angle of internal friction, ϕ', of 35^0 and total unit weight, γ, of 120 pcf. The analyses indicate that ground improvement accomplished to a minimum depth of 20 ft under the full width of the embankment and side slopes provides a factor of safety of about 1.2 during the design-level earthquake.

Ground Improvement of Railroad Embankment. Ground improvement methods for the undercrossing alternative are similar to those discussed in the Ground Improvement section for the overcrossing alternative.

Differential Settlements of Railroad for Undercrossing Alternative

The rail bridge for the undercrossing alternative will likely be supported on piles. Following a design-level earthquake, differential settlements up to 18 in. are possible between pile-supported bridge and adjacent portions of the track without ground improvement. Regardless of the depth of ground improvement, it should be anticipated that differential settlement will occur along the tracks between the bridge structure, improved soils, and unimproved soils. In this regard, re-leveling of the railroad embankment and tracks will be necessary following a design-level earthquake as part of the undercrossing alternative.

Shoofly Fills for Undercrossing Alternative

As discussed previously, fills up to 14 ft thick will be constructed for the temporary embankment to support the shoofly for the undercrossing alternative. Due to space constraints, the shoofly embankment will consist of a combination MSE wall along the west edge of the embankment and 2H:1V unretained side slopes along the east edge of the embankment. Based on the boring completed for this project, the fills will induce settlement under static conditions that will essentially occur as the fill is placed. However, settlement of the temporary shoofly embankments should be re-evaluated following completion of additional borings for the final design.

Other Considerations

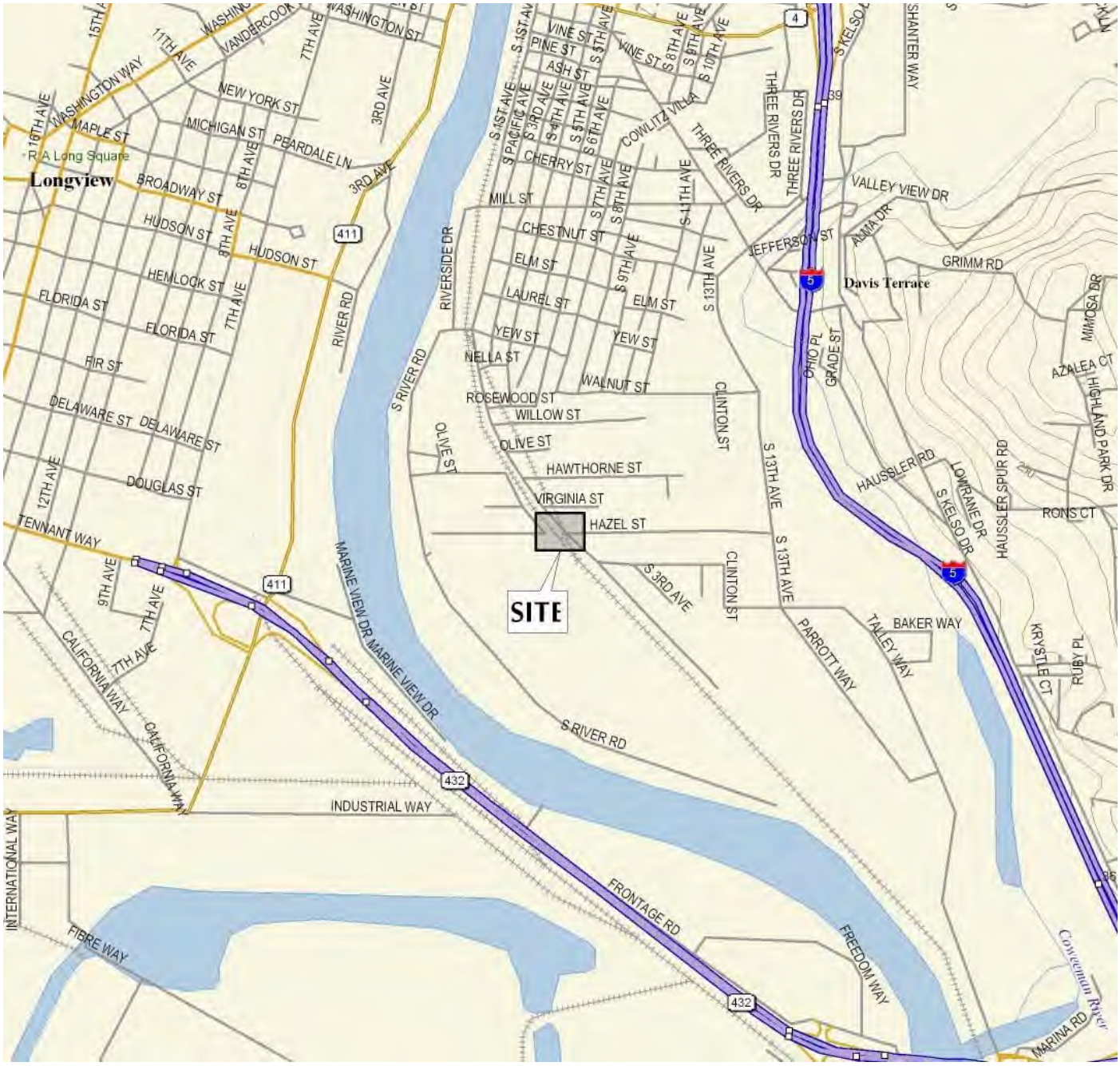
As part of the undercrossing alternative, it should be anticipated that significant portions of the existing railroad embankment will be removed as well as portions of Hazel Street and South Pacific Avenue. Due to the unknown nature of the fills used to create the railroad embankment as well as the possibility of fills over other portions of the site, we recommend conducting a Phase 1 Hazardous Material Assessment for either alternative.

LIMITATIONS

This preliminary report has been prepared to aid the design team and the City of Kelso in the selection of the preferred alternative and preliminary design of this project. The findings presented herein are based on the data obtained from the boring made at the location indicated on Figures 2 and 3 and from other sources of information discussed in this report. In the performance of subsurface investigations, specific information is obtained at specific locations at specific times. However, it is acknowledged that variations in soil conditions may exist beyond the boring location. The scope of our investigation was limited by the fact that actual plans for development are indefinite; hence, only preliminary opinions are presented. Significant limitations are inherent in a study of this type, and additional site investigations should be conducted as specific construction plans and designs are developed. The information provided in this report is not intended for final design of the project. Additional exploration work and engineering studies and analyses will be necessary to develop recommended criteria and guidelines for final design.

Submitted for GRI,

Dwight J. Hardin, PE Principal	Scott M. Schlechter, PE Associate	Brian J. Bayne, PE Project Engineer



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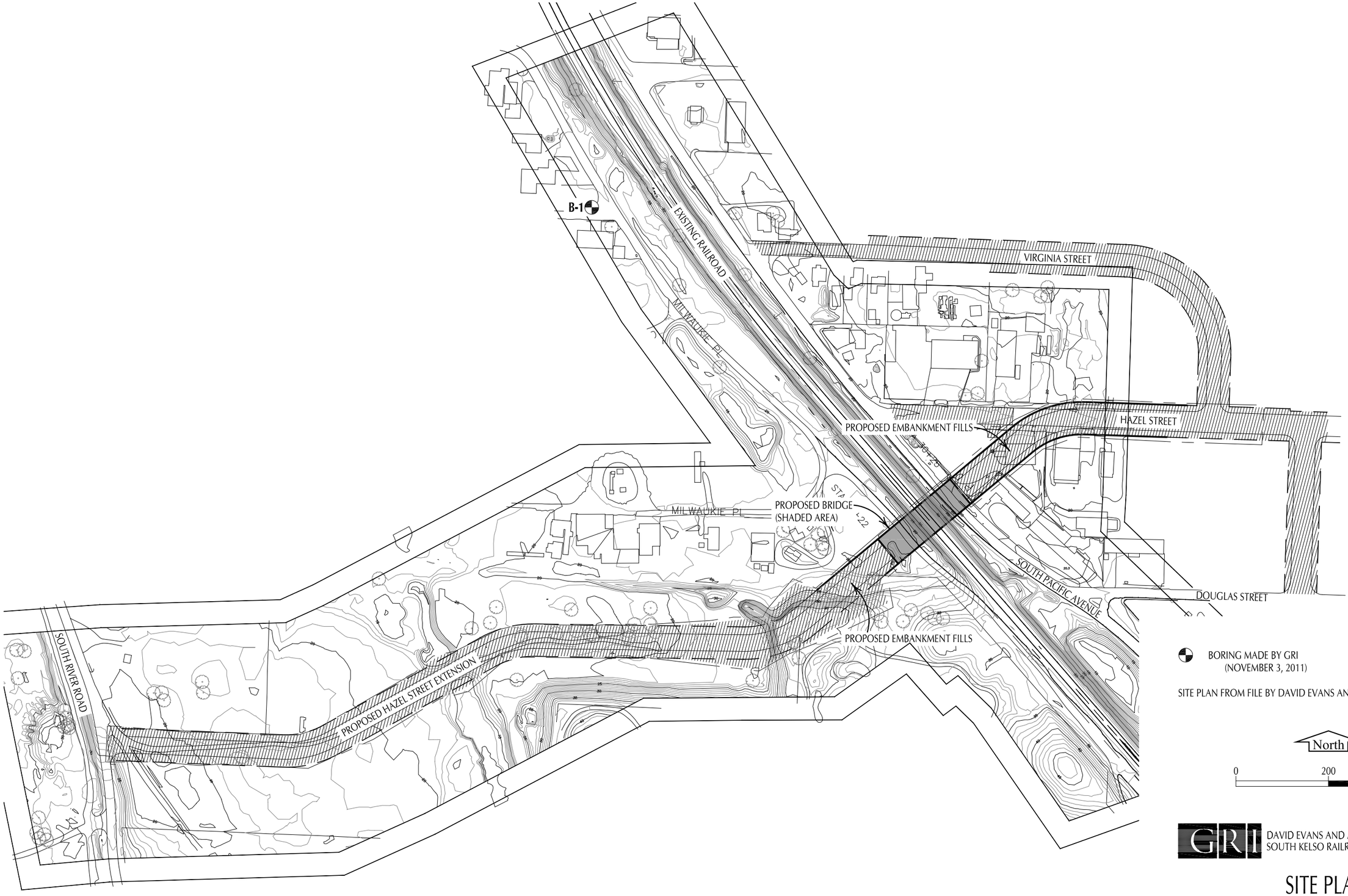
GRI DAVID EVANS AND ASSOCIATES, INC.
SOUTH KELSO RAILROAD CROSSING

VICINITY MAP

JAN. 2012 JOB NO. W1081 FIG. 1



BORING MADE BY GRI
(NOVEMBER 3, 2011)

SITE PLAN FROM FILE BY DAVID EVANS AND ASSOCIATES, INC. (UNDATED)

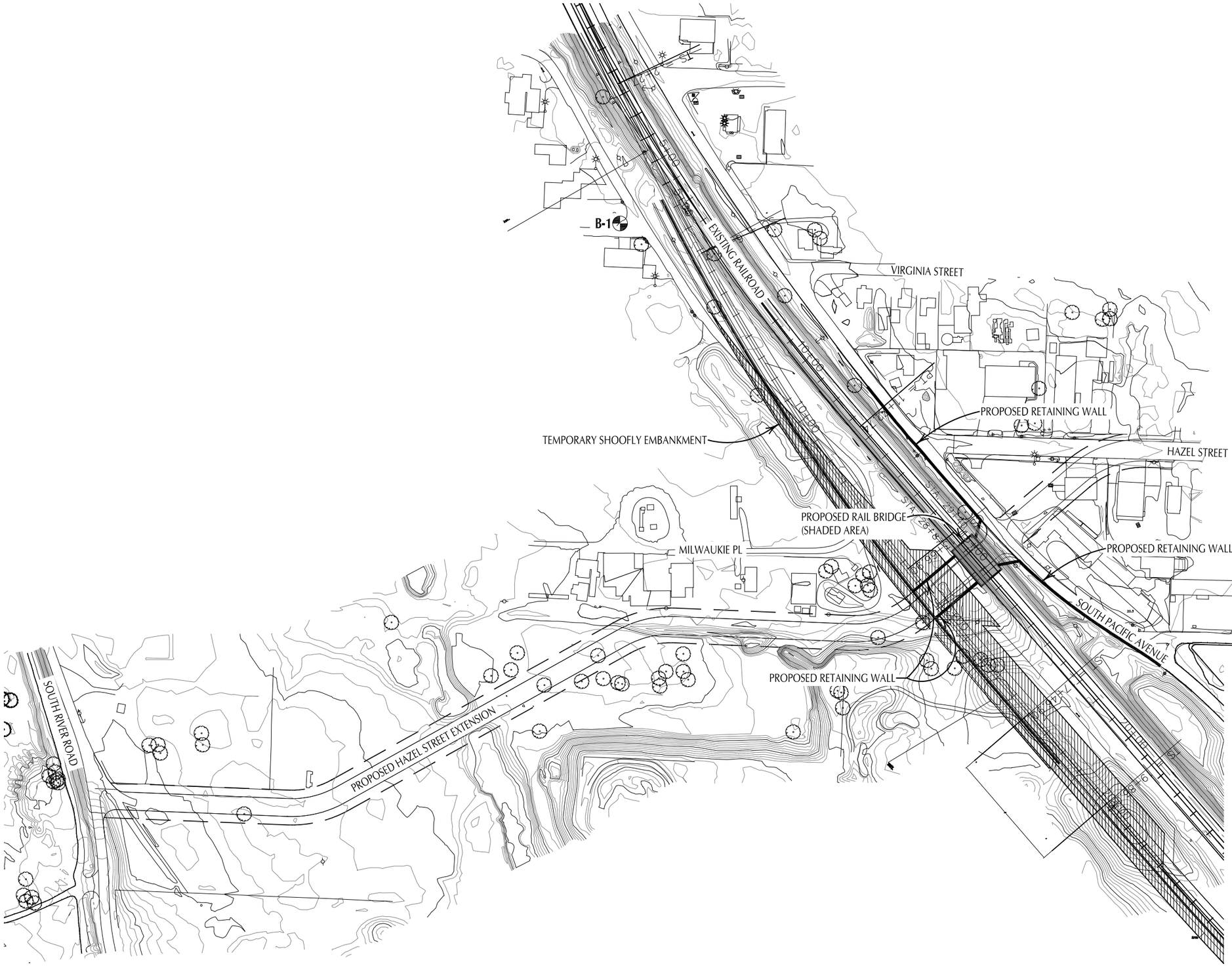
North

0 200 400 FT

GRI DAVID EVANS AND ASSOCIATES, INC.
SOUTH KELSO RAILROAD CROSSING

SITE PLAN
(OVERCROSSING ALTERNATIVE)

JAN. 2012 JOB NO. W1081 FIG. 2



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SITE PLAN FROM FILE BY DAVID EVANS AND ASSOCIATES, INC. (UNDATED)

North

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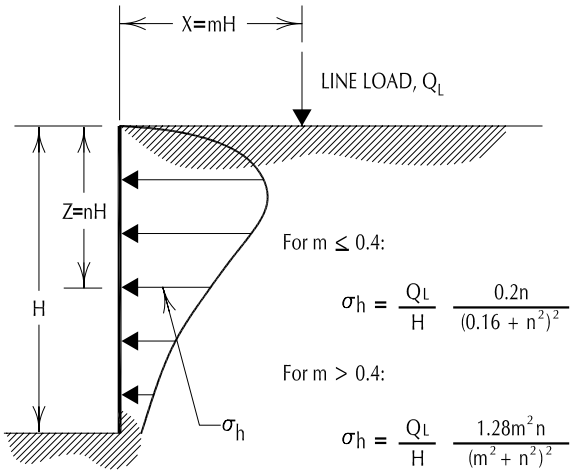
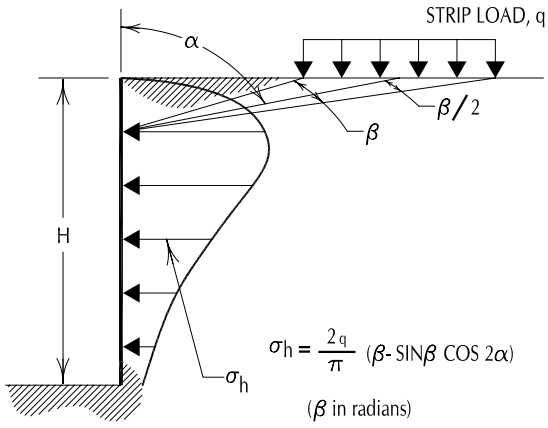
GRI DAVID EVANS AND ASSOCIATES, INC.
SOUTH KELSO RAILROAD CROSSING

SITE PLAN
(UNDERCROSSING ALTERNATIVE)

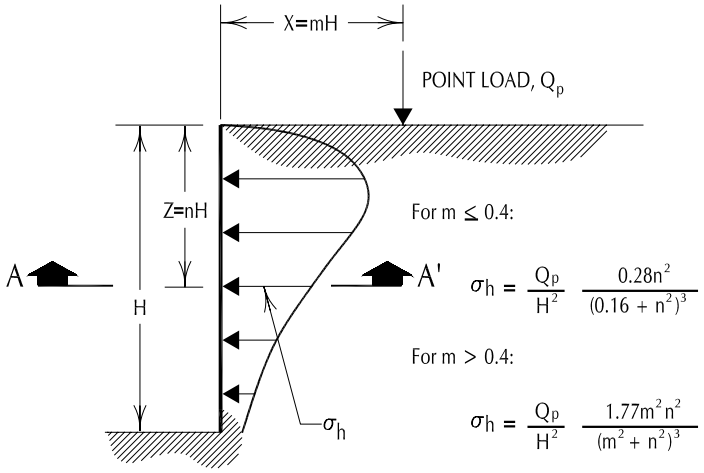
JAN. 2012 JOB NO. W1081 FIG. 3

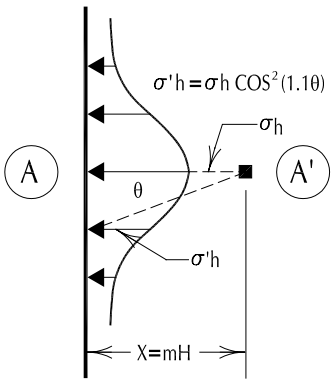


LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL





DISTRIBUTION OF HORIZONTAL PRESSURES

VERTICAL POINT LOAD

NOTES:

1. THESE GUIDELINES APPLY TO RIGID WALLS WITH POISSON'S RATIO ASSUMED TO BE 0.5 FOR BACKFILL MATERIALS.

2. LATERAL PRESSURES FROM ANY COMBINATION OF ABOVE LOADS MAY BE DETERMINED BY THE PRINCIPLE OF SUPERPOSITION.

DAVID EVANS AND ASSOCIATES, INC.
SOUTH KELSO RAILROAD CROSSING

SURCHARGE-INDUCED LATERAL PRESSURE

JAN. 2012 JOB NO. W1081 FIG. 4

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATIONS

General

Subsurface materials and conditions at the site were investigated on November 3, 2011, with one boring, designated B-1. The approximate location of the boring is shown on Figures 2 and 3. An experienced geologist from GRI directed the drilling and maintained a detailed log of the materials and conditions disclosed during the course of the work. The boring was advanced to a depth of 101.5 ft with mud-rotary drilling methods using a truck-mounted drill rig provided and operated by Western States Soil Conservation, Inc. of Hubbard, Oregon. Disturbed samples were typically obtained at 5-ft intervals of depth in the upper 60 ft and at 10-ft intervals below this depth. Disturbed samples were obtained using a standard split-spoon sampler. At the time of sampling, the Standard Penetration Test was conducted. This test consists of driving a standard split-spoon sampler into the soil a distance of 18 in. using a 140-lb hammer dropped 30 in. The number of blows required to drive the sampler the last 12 in. is known as the standard penetration resistance, or N-value. The N-values provide a measure of the relative density of granular soils, such as sand, and the relative consistency, or stiffness, of cohesive soils, such as silt. The split-spoon samples were carefully examined in the field and representative portions were saved in airtight jars. All samples were returned to our laboratory for further examination and physical testing.

The log of boring B-1 is provided on Figure 1A, which provides a descriptive summary of the various types of materials encountered in the boring and notes the depth at which the materials and/or characteristics of the materials change. To the right of the descriptive summary, the depth to groundwater and the numbers and types of samples are indicated. Farther to the right, N-values are shown graphically, along with natural moisture contents and percent passing the No. 200 sieve. The terms used to describe the soils encountered in the boring are defined in Table 1A.

LABORATORY TESTING

General

All samples obtained from the boring were returned to our laboratory, where the physical characteristics of the samples were noted, and the field classifications were modified where necessary. At the time of classification, the natural moisture content of each sample was determined. Additional testing included washed sieve analysis. The following paragraphs describe the testing program in more detail.

Natural Moisture Content

Natural moisture content determinations were made in conformance with ASTM D 2216. The results are provided on Figure 1A.

Grain Size (Washed-Sieve Analysis)

Washed sieve analyses were performed on representative soil samples to assist in their classification. The test is performed by taking a sample of known dry weight and washing it over a No. 200 sieve. The material retained on the sieve is oven-dried and weighed, and the percentage of material passing the No. 200 sieve is calculated. The test results are provided on Figure 1A.

Table 1A

GUIDELINES FOR CLASSIFICATION OF SOIL

Description of Relative Density for Granular Soil

Relative Density	Standard Penetration Resistance (N-values) blows per foot
very loose	0 – 4
loose	4 – 10
medium dense	10 – 30
dense	30 – 50
very dense	over 50

Description of Consistency for Fine-Grained (Cohesive) Soils

Consistency	Standard Penetration Resistance (N-values) blows per foot	Torvane Undrained Shear Strength, tsf
very soft	2	less than 0.125
soft	2 - 4	0.125 - 0.25
medium stiff	4 - 8	0.25 - 0.50
stiff	8 - 15	0.50 - 1.0
very stiff	15 - 30	1.0 - 2.0
hard	over 30	over 2.0

Sandy silt materials, which exhibit general properties of granular soils are given relative density description.

Grain-Size Classification

Boulders
12 - 36 in.

Cobbles
3 - 12 in.

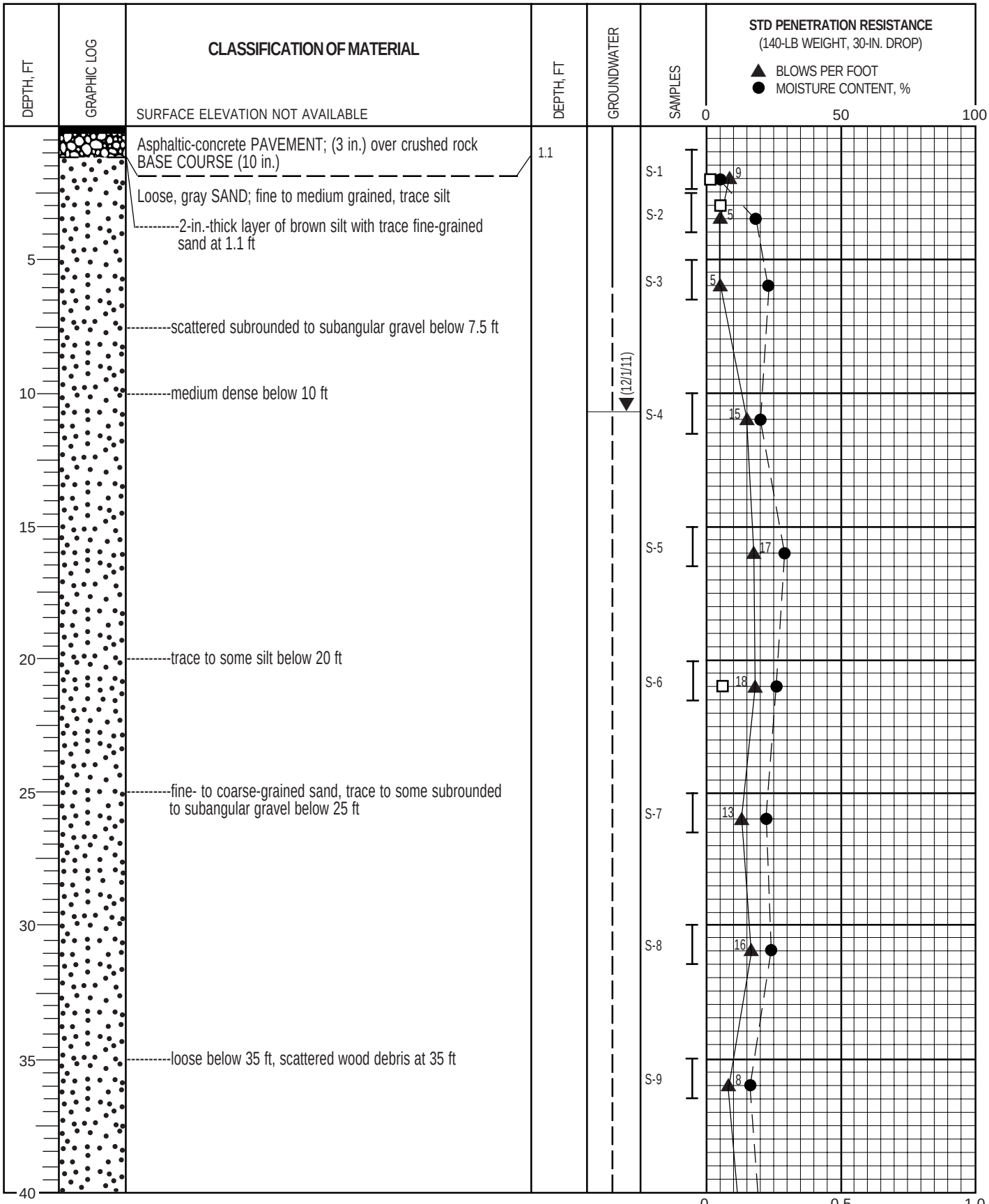
Gravel
1/4 - 3/4 in. (fine)
3/4 - 3 in. (coarse)

Sand
No. 200 - No. 40 sieve (fine)
No. 40 - No. 10 sieve (medium)
No. 10 - No. 4 sieve (coarse)

Silt/Clay - pass No. 200 sieve

Modifier for Subclassification

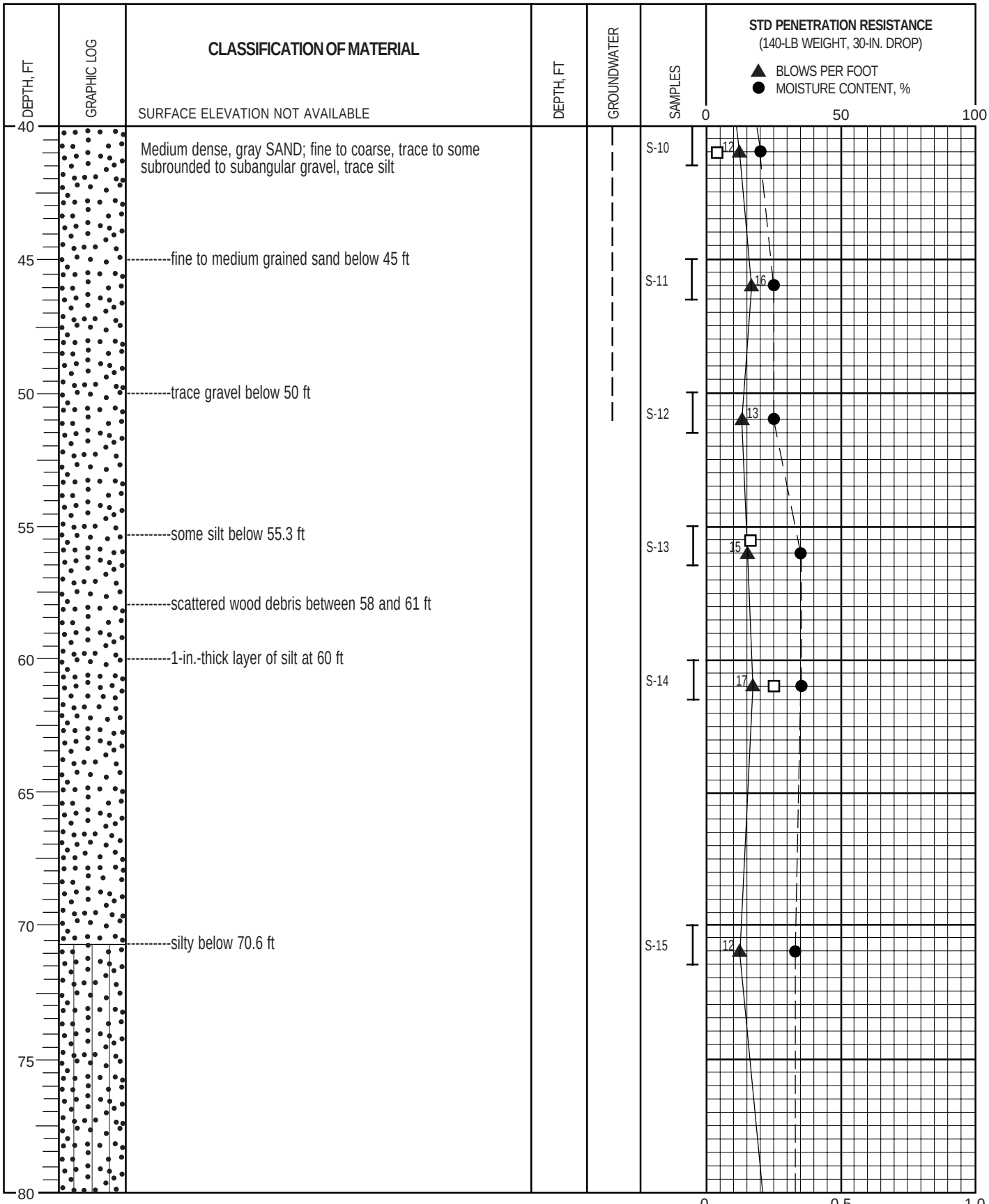
Adjective	Percentage of Other Material In Total Sample
clean	0 - 2
trace	2 - 10
some	10 - 30
sandy, silty, clayey, etc.	30 - 50



GRI

BORING B-1

JAN. 2012 JOB. NO. W1081 FIG. 1A



2-IN.-OD SPLIT-SPOON SAMPLER

3-IN.-OD THIN-WALLED SAMPLER

G GRAB SAMPLE OF DRILL CUTTINGS

SLOTTED PVC PIPE

Water Level (date)

TORVANE SHEAR STRENGTH, TSF

PERCENT PASSING NO. 200 SIEVE (WASHED)

* NO RECOVERY

Liquid Limit

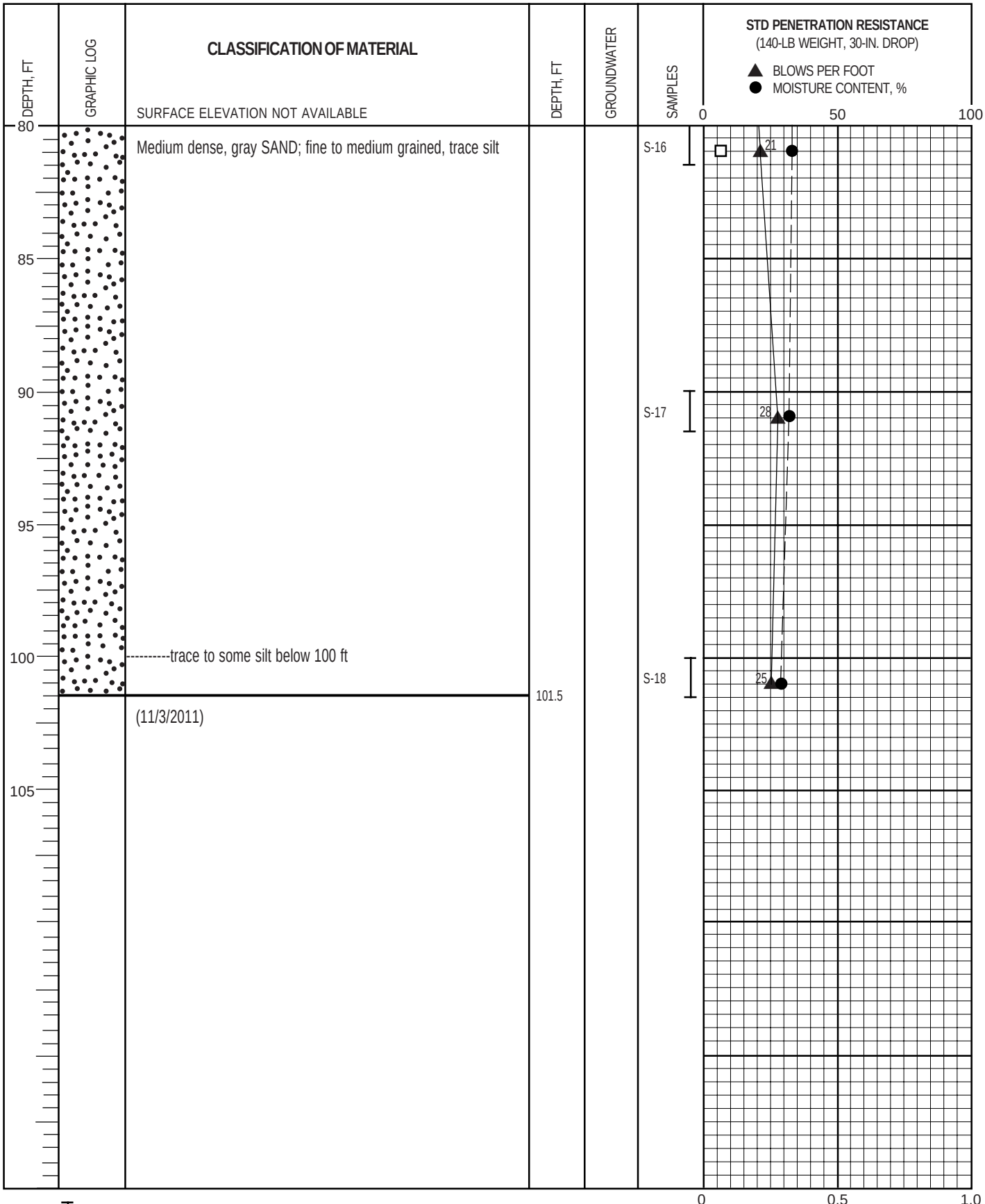
Moisture Content

Plastic Limit

GRI

BORING B-1 (cont.)

JAN. 2012 JOB. NO. W1081 FIG. 1A



2-IN.-OD SPLIT-SPOON SAMPLER

3-IN.-OD THIN-WALLED SAMPLER

G GRAB SAMPLE OF DRILL CUTTINGS

SLOTTED PVC PIPE

Water Level (date)

TORVANE SHEAR STRENGTH, TSF

PERCENT PASSING NO. 200 SIEVE (WASHED)

* NO RECOVERY

Liquid Limit

Moisture Content

Plastic Limit

GRI

BORING B-1 (cont.)

JAN. 2012 JOB. NO. W1081 FIG. 1A

Appendix D

Traffic Analysis

Appendix D

FINAL: South Kelso Railroad Crossing Study

Traffic Analysis

Kelso, Washington

Prepared for

City of Kelso

Prepared by

David Evans and Associates, Inc.
2100 SW River Parkway
Portland, Oregon 97201

March 2013

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1. PROJECT SUMMARY

The primary objectives for the South Kelso Railroad Study are to clearly establish the need for a safe grade-separated crossing, evaluate crossing options, recommend a preferred alternative, and, most importantly, provide a preliminary design that is usable for future phases, should the final design and construction funding be delayed. This memorandum summarizes findings from the traffic analysis performed for the Study. An analysis of operations has been conducted for existing (2011) and future (2035) conditions for the future site of the rail crossing at Hazel Street. System elements such as lane configurations and traffic control devices were also evaluated in conjunction with several growth scenarios to provide recommendations for a range of possible outcomes.

Study Area

The study area is located on the west side of the city of Kelso, Washington. Two existing at-grade railroad crossing serve an area bounded by railroad tracks to the east side and the Cowlitz River to the west, as illustrated in Figure 1. The new grade-separated railroad crossing is proposed at Hazel Street and South Pacific Avenue. Just over half a mile north of the new crossing, there are two existing at-grade crossings to the north at Yew Street/South River Road and Mill Street. The grade-separated crossing would replace one (Yew Street/South River Road), or possibly both, of the existing at-grade crossings.

2. EXISTING CONDITIONS

The existing conditions analysis addresses the current railroad crossing geometry and existing traffic volumes. It also reviews the crash history in the study area.

Existing Crossing Geometry

Two roadways currently cross the railroad tracks in the study area: Mill Street and Yew Street/South River Road. Both of these crossing are at grade.

Mill Street

Mill Street is a two-lane roadway which crosses the railroad tracks at the northern end of the study area. Although it passes through a predominantly residential neighborhood, Mill Street connects directly into the Three Rivers Mall. The two Cowlitz Rivers crossings and I-5 Exit 39 lie to the north of Mill Street. Mill Street connects with Riverside Drive on the west side of the railroad tracks.

Mill Street crosses the railroad tracks at a nearly perpendicular angle with some grade change but no steep slopes. The crossing itself has an active control system that includes flashing lights and arms that lower to halt traffic when a train is approaching.

Traffic using the Mill Street crossing may be coming along Mill Street or from South Pacific Avenue or any of the other north-south roads connecting to downtown.

Figure 1. Study Area

Yew Street/South River Road

Yew Street is a two-lane roadway that transitions to South River Road at a slightly offset intersection on South Pacific Avenue. Yew Street/South River Road crosses the railroad tracks approximately 1,600 feet south of Mill Street. Yew Street is a local street that serves only the adjacent residential neighborhoods with no through traffic. South River Road is a local street that serves development west of the railroad tracks.

Because of the proximity of the railroad tracks and South Pacific Avenue, Yew Street/South River Road crosses the railroad tracks at a skewed angle with a steeper grade as it climbs up the railroad embankment. The rail crossing connection to South Pacific Avenue is off-set from Yew Street itself because of the grade differences between the roadway network and the railroad tracks. The crossing itself has an active control system that includes flashing lights and arms that lower to halt traffic when a train is approaching.

Most of the traffic using the Yew Street/South River Road crossing is traveling northbound or southbound on South Pacific Avenue. The awkward intersection configuration can make it difficult for large vehicles traveling northbound on South Pacific Avenue to turn left, climb the embankment, and cross the railroad tracks. The Yew Street/South River Road crossing carries more traffic traveling to and from areas to the south than the Mill Street crossing.

Existing Traffic Volumes

Throughout the study area, traffic volumes were collected by the City between November 28 and December 15, 2011. The counts, which were bidirectional and included a breakdown of vehicle classification, were collected at five locations. Summaries of the count locations and when they were collected are presented in Table 1. See Appendix D-1 for detailed count data.

Table 1. Summary of Traffic Count Locations

Count Location	Dates of Data Collection
South River Road: South of Riverside Drive	11/28/2011 – 12/6/2011
South Pacific Avenue: From Hazel Street to Willow Street	12/8/2011 – 12/15/2011
South River Road: South Pacific Avenue to Riverside Drive*	11/28/2011 – 12/6/2011
Mill Street: 3rd Avenue to South Pacific Avenue	11/28/2011 – 12/6/2011
Riverside Drive: West of RR Tracks	12/2/2011 – 12/9/2011

*Count data was not collected along Yew Street east of the Railroad tracks

Source: City of Kelso, Washington; compiled by David Evans and Associates, Inc.

Traffic volume data were collected during the winter of 2011. Because recreational activity in the area, particularly at the Three Rivers Golf Course, is much lower in the winter than the summer, the traffic volumes were seasonally adjusted to summer conditions. Summer traffic volumes were estimated by adding traffic generated by an 18-hole golf course on a typical

summer day[1] to the winter volumes. While there is some golf course activity during the winter, the full estimate of trips generated by a golf course was added to account for other higher activity during summer months as well. The existing daily traffic for the study area crossings may be seen in the table below.

Table 2. Summary of Existing (2011) Daily Traffic Counts

Railroad Crossing	Weekday Traffic (veh/day)		Weekend Traffic (veh/day)	
	Winter 2011	Summer 2011	Winter 2011	Summer 2011
Mill Street At-Grade	350	475	200	325
Yew Street/South River Road At-Grade	1,445	1,965	1,175	1,695
Total Crossing Volume	1,795	2,440	1,375	2,020

Source: City of Kelso, Washington; compiled by David Evans and Associates, Inc.

Although the Mill Street crossing is closer to downtown, the Yew Street/South River Road crossing carries the higher traffic volumes on both weekdays and weekend days.

Crash Analysis

A crash analysis was conducted to determine whether any significant, documented safety issues exist within the study area. As part of the crash analysis, historical crash data were reviewed for the roadway system and the rail crossings. Appendix D-2 has a comprehensive list of the crash data.

Roadway Crash History

The crash analysis included a review of crash history data supplied by the Washington State Department of Transportation (WSDOT) Collision Data and Analysis Branch for the period between January 1, 2006, and December 31, 2010, which were the five most recent full years for which crash data were available at the time of the analysis.

The crash analysis shows 16 crashes at key locations within the study area, as summarized in Table 3. Most of the crashes were property damage only (12). There were no fatalities reported at study area intersections.

The intersection of Mill Street and South Pacific Avenue had the greatest number of reported crashes (6). One half of these crashes resulted in an injury. Collision types included rear end (2), angle (2), and sideswipe (2).

The Yew Street/South River Road intersection with South Pacific Avenue had 4 reported property damage only crashes. Collision types included rear end (1), angle (1), and sideswipe (2).

[1] Daily traffic volumes for a typical weekday and weekend day were estimated using the average trip rates for a golf course from the Institute of Transportation Engineers *Trip Generation* Manual, 8th edition.

Three property damage only crashes were reported at the South River Road crossing of the railroad tracks. None were related to train activity. Two of the crashes involved a single vehicle collision with a fixed object. The third crash was identified as non-collision and involved two vehicles.

The South River Road intersection with Riverside Drive had 3 reported crashes; one resulted in an injury. Two of the collisions involved a single vehicle with a fixed object. One collision was categorized as "other" and involved two vehicles and resulted in an injury.

Table 3. Summary of Crashes at Key Locations

Intersection	Total Crashes	Severity of Crash			Collision Type					
		Fatality/ Serious Injury	Injury	Property Damage Only	Rear End	Angle	Sideswipe	Fixed Object	Non- Collision	Other
Mill St @ South Pacific Ave	6	0	3	3	2	2	2	0	0	0
Yew St/South River Rd@ South Pacific Ave	4	0	0	4	1	1	2	0	0	0
South River Rd @ RR Crossing	3	0	0	3	0	0	0	2	1	0
South River Rd @ Riverside	3	0	1	2	0	0	0	2	0	1
Totals	**16**	**0**	**4**	**12**	**3**	**3**	**4**	**4**	**1**	**1**

Source: Washington State Department of Transportation Collision Data and Analysis Branch; compiled by David Evans and Associates, Inc.

Rail Crash History

The crash history along the BNSF was compiled from data provided by the Federal Rail Administration's (FRA) Web Accident Prediction System (WBAPS)[2]. WBAPS generates reports of public rail intersections ranked by predicted collisions per year. This data is based upon the information provided to the FRA by the state, and may not include all crashes. The rankings are not meant to be a standalone list and should be used in conjunction with engineering judgment and further evaluation to identify rail crossing locations which may require additional attention. The WBAPS "accident prediction formula" is based upon basic data about the crossing's physical and operating characteristics as well as five years of crash history.

Table 4 lists three BNSF crossings within the City of Kelso. The Cowlitz Garden crossing, which lies beyond the study area, has the highest risk ranking of the three crossings. This crossing did have a property damage only crash which occurred in 2006.

Neither the existing Yew Street/South River Road crossing nor Mill Street crossing had a reported crash for the most recent five years of available data (January 1, 2006 through December 31, 2010). The database ranks the Mill Street crossing slightly higher for risk potential than the Yew Street/South River Road crossing, most likely because the database

[2] http://safetydata.fra.dot.gov/webaps/

assumes higher traffic volumes at this location, which conflicts with the traffic count data collected by the City in 2011. However, based on engineering judgment, the sight distance and geometry at Yew Street/South River Road crossing are worse than the Mill Street crossing.

Table 4. Summary of Railroad Crossings

Crossing ID	Street Name	Railroad	No. of Tracks	Warning Device Type
092466V	Cowlitz Garden	BNSF	3	Gate
092458D	Mill Street	BNSF	3	Gate
092457W	Yew Street (South River Road)	BNSF	3	Gate

Source: Federal Railroad Administration Office of Safety Analysis Highway-Rail Crossing Safety & Trespass Prevention, Web Accident Predication System (WBAPS); compiled by David Evans and Associates, Inc.

It should also be noted that database volumes are considerably lower than the volumes measured in 2011 for this traffic study.

Future Traffic Conditions

The new grade-separated railroad crossing is proposed at Hazel Street and South Pacific Avenue (see Figure 1) approximately one-half mile south of the two existing at-grade crossings at Yew Street/South River Road and Mill Street. The grade-separated crossing could replace at least one of the existing at-grade crossings. It is likely Yew Street/South River Road could be closed with the construction of the Hazel Street crossing. Mill Street could also be closed to regular traffic, although this is not desired because of impacts to emergency vehicle services. Scenarios considering both these options were evaluated.

Future Traffic Volumes

To evaluate a range of possible growth scenarios, two growth rates were considered for the study area. An annual growth rate of 0.5 percent per year was initially considered as a low end scenario with little redevelopment or growth in the area west of the railroad tracks. A higher growth rate of 2.0 percent per year was added to account for redevelopment at higher densities in some of the study area west of the railroad tracks. These growth rates were applied to the estimated 2011 summer weekday traffic volumes. Only weekday volumes were developed for the future condition because the weekday volumes were consistently higher than the weekend volumes.

Future Traffic with Existing At-Grade Crossings

The projected weekday traffic for each existing at-grade crossing and growth scenario are presented in Table 5.

Table 5. Summary of Future (2035) Volume Estimates with Current Crossings

Railroad Crossing	2035 Weekday Traffic (veh/day)	
	0.5% Growth	2% Growth
Mill Street At-Grade	535	765
Yew Street/South River Street At-Grade	2,215	3,160
Total Crossing Volume	**2,750**	**3,925**

Source: David Evans and Associates, Inc.

Future Traffic with Hazel Street Grade-Separated Crossing

Two at-grade crossing closure scenarios were considered with construction of grade-separated crossing at Hazel Street: 1) closure of just the Yew Street/South River Road crossing and 2) closure of both the Yew Street/South River Road and Mill Street crossings with emergency vehicle access remaining at Mill Street.

The straight-line growth scenarios evaluated for year 2035 traffic operations are summarized below:

- Low Option 1 – 0.5% growth per year and Yew St/South River Rd crossing closure
- Low Option 2 – 0.5% growth per year and Yew St/South River Rd and Mill St crossing closure
- High Option 1 – 2% growth per year and Yew St/South River Rd crossing closure
- High Option 2 – 2% growth per year and Yew St/South River Rd and Mill St crossing closure

The projected weekday traffic for each existing at-grade crossing and growth scenario are presented in Table 6.

Table 6. Summary of Future (2035) Volume Estimates withHazel Street Grade-Separated Crossing

Railroad Crossing	2035 Weekday Traffic (veh/day)			
	0.5% Growth		2% Growth	
	Low Option 1 (Yew/South River Crossing Closed)	Low Option 2 (Both At-Grade Crossings Closed)	High Option 1 (Yew/South River Crossing Closed)	High Option 2 (Both At-Grade Crossings Closed)
Mill Street At-Grade	980	0	1,395	0
Yew Street/South River Road At-Grade	0	0	0	0
Hazel Street Grade-Separated	1,770	2,750	2,525	3,920

Source: David Evans and Associates, Inc.

If only the Yew Street/South River Road crossing were to be closed, the estimated weekday volumes across the new Hazel Street crossing are 1,770 vehicles for the low-growth scenario and 2,525 vehicles for the high-growth scenario. The closing of both the Yew Street/South River Road and Mill Street crossings would result in ADT volumes across the new Hazel St crossing of

approximately 2,750 vehicles for the low-growth scenario and 3,920 vehicles for the high-growth scenario. Both growth scenario forecasts are within the volume range typical for a two-lane arterial roadway and neither growth scenario warrants turn lanes along Hazel Street at this time.

Traffic Considerations with Hazel Street Crossing

The Hazel Street railroad crossing will be grade-separated with either a structure crossing over the railroad tracks or a new road passing under the railroad tracks.

Hazel Street Undercrossing Alternative

Hazel Street/South Pacific Avenue is currently STOP-controlled with a less typical configuration for the three-leg intersection. Because the highest travel movements occur between the Hazel Street leg and the north leg of South Pacific Avenue, these movements flow freely while the south leg of South Pacific Avenue is stopped. With the Hazel Street Undercrossing Alternative, the intersection would go from three legs to four legs and alternative traffic control configurations should be considered.

Signal Warrant Analysis

From a traffic analysis standpoint, the alternative that will create the busiest intersection operations would be the undercrossing connection at South Pacific Avenue. Therefore, signal warrants were evaluated for that intersection.

Because traffic signals generate more average vehicle delay and typically have higher crash rates, a series of criteria or warrants were developed to identify when a traffic signal should be considered. The warrants used most frequently are traffic volume based; it is generally desirable for the 4-hour volumes or 8-hour volumes warrant to be met.

Preliminary signal warrant analysis would suggest that under existing conditions, the vehicular volumes are not high enough to warrant a signal. Even with the high-growth scenario in 2035 and both at-grade crossings closed, volumes are not expected to warrant a signal at the intersection of Hazel Street and South Pacific Avenue.

STOP Control Options

With the Hazel Street undercrossing Alternative, the intersection would go from three legs to four legs and alternative STOP-control configurations should be considered. There are three typical configurations which could be applied:

- Two-way STOP-control that stops traffic on Hazel Street and allows free movement of traffic on South Pacific Avenue
- Two-way STOP-control that stops traffic on South Pacific Avenue and allows free movement of traffic on Hazel Street
- All-way STOP-control that stops traffic on both Hazel Street and South Pacific Avenue

Although traffic data were not available for peak hours, the daily volumes were assessed assuming that ten percent of the traffic demand would occur during the peak hour and that 60 percent of the traffic would travel in the peak direction. Based on these assumptions, any of the three STOP-control configurations could be applied to the Hazel Street/South Pacific Avenue intersection with the expectation that stopped traffic would experience relatively short delays.

Cross-Section

A two-lane or three-lane cross-section for the Undercrossing Alternative would be adequate for the forecast traffic demand on Hazel Street. The advantage of the three-lane cross-section would be additional storage capacity in the short section of roadway that would connect between South Pacific Avenue east of the railroad tracks and Milwaukee Place west of the railroad tracks.

Traffic Circulation

The creation of a new railroad crossing at Hazel Street would cause some change in traffic circulation patterns in the area. Traffic to/from the north (i.e., residential neighborhoods, Three Rivers Mall, and downtown) would have to travel further south than Yew Street/South River Road to cross the railroad tracks. This could result in more demand at the Mill Street crossing. Traffic volumes on South Pacific Avenue between Yew Street and Hazel Street might increase as drivers travel to the Hazel Street crossing. However, this increase might be offset by a reduction in traffic demand to/from the south (i.e. industrial area and airport), since these drivers would have a shorter travel distance with the new crossing.

Hazel Street Overcrossing Alternative

The Hazel Street Overcrossing Alternative would eliminate the Hazel Street intersection with Souht Pacific Avenue and route traffic onto Douglas Street instead.

Signal Warrant Analysis

Traffic demand at the Douglas Street/South Pacific Avenue intersection with the Overcrossing Alternative would likely be lower than the demand at the Hazel Street/South Pacific Avenue intersection with the Undercrossing Alternative. Therefore, signal warrants would not be met at the Douglas Street/South Pacific Avenue intersection with this Alternative.

STOP Control Options

The Hazel Street Overcrossing Alternative would eliminate the Hazel Street intersection with South Pacific Avenue and route traffic onto Douglas Street instead. Two-way STOP control could be applied to the Douglas Street/South Pacific Avenue intersection as well as the new intersections created by the Hazel Street overcrossing alternatives because all of these intersections would likely have lower volumes than the undercrossing alternative.

Cross-Section

A two-lane cross-section for the Overcrossing Alternative would be adequate for the forecast traffic demand on Hazel Street. Because intersection spacing would be greater with this Alternative, there is less need for additional storage created by turn lanes.

Traffic Circulation

In addition to the traffic circulation changes discussed for the Undercrossing Alternative, the Overcrossing Alternative would likely affect traffic demand on Douglas Street. Because Hazel Street would no longer connect directly to South Pacific Avenue with the Overcrossing Alternative, Douglas Street would become the primary travel route between South Pacific Avenue and Talley Way. Additional evaluation of the intersections along that route and how an increase in traffic demand could affect traffic flow and safety is recommended.

3. KEY FINDINGS AND RECOMMENDATIONS

This memorandum summarizes findings from the traffic analysis performed for the South Kelso Railroad Study which considers a proposed grade-separated rail crossing at South Pacific Avenue and Hazel Street. System elements such as lane configurations and traffic control devices were also evaluated in conjunction with two growth scenarios to provide recommendations for a range of possible outcomes. Based on the conducted analyses, the following key findings have been identified.

Key Findings

- Two-way STOP control at the Hazel Street undercrossing intersection with South Pacific Avenue is adequate for all growth scenarios presented in this memo.
- Two-way STOP control can be applied to the Douglas Street intersection with South Pacific Avenue and the new intersections created by the Hazel Street Overcrossing Alternative.
- Given the estimate of peak-period and ADT volume, a three-lane east-west roadway section for the Hazel Street undercrossing would generally provide for more than adequate operations through year 2035, though a two lane facility would also work.
- A two-lane east-west section for the Hazel Street overcrossing would provide sufficient capacity.
- A traffic signal would not be warranted for any scenario or alternative.

South Kelso Railroad Crossing Study

Traffic Analysis

Appendix D-1: Kelso Traffic Counts

Order # : 11-28-3
Street Ref. # : River AV-S end
From - To : S River Rd. to 1st turn

Site: River AV-S end
S. River Rd (s. of Riverside Dr.)

Channels
Volume — A Tube, B Tube
Speed — Near lane flow, Far lane flow
Classification — Near lane flow, Far lane flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclassified
Monday															
11/28/2011															
Speed (mph)															
Class (%)		0.0	71.4	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	14													
Tuesday															
11/29/2011															
Speed (mph)															
Class (%)		0.0	67.6	24.3	0.0	5.4	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0
	Total	37													
Wednesday															
11/30/2011															
Speed (mph)															
Class (%)		0.0	73.9	21.7	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	46													
Thursday															
12/01/2011															
Speed (mph)															
Class (%)		0.0	72.3	21.3	0.0	4.3	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	47													
Friday															
12/02/2011															
Speed (mph)															
Class (%)		0.0	73.3	15.6	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	45													
Saturday															
12/03/2011															
Speed (mph)															
Class (%)		0.0	61.5	15.4	0.0	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	26													
Sunday															
12/04/2011															
Speed (mph)															
Class (%)		0.0	68.4	21.1	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	19													

Monday 11/28/2011
Vehicles: 33 — **% Axles Used** A: 87.5 B: 82.4
Avg. Axles Per Vehicle: 2.00 — **Avg. Two-Axle Wheelbase:** 9.3 ft.
Peak Hour, 12:00 PM - 12:00 AM 7:45 PM Volume: 9 Factor: 0.45
Speed (mph) **Average:** 19.3 **Percentiles:** **10%:** 13.2 **15%:** 15.4 **50%:** 19.0 **85%:** 21.9 **90%:** 22.1

Tuesday 11/29/2011
Vehicles: 76 — **% Axles Used** A: 100.0 B: 100.0
Avg. Axles Per Vehicle: 2.03 — **Avg. Two-Axle Wheelbase:** 9.4 ft.
Peak Hour, 12:00 AM - 12:00 PM 1:15 AM Volume: 12 Factor: 0.5
Peak Hour, 12:00 PM - 12:00 AM 2:00 PM Volume: 12 Factor: 0.5
Speed (mph) **Average:** 19.8 **Percentiles:** **10%:** 9.8 **15%:** 11.1 **50%:** 20.4 **85%:** 25.2 **90%:** 25.7

Wednesday 11/30/2011
Vehicles: 98 — **% Axles Used** A: 97.9 B: 92.9
Avg. Axles Per Vehicle: 2.00 — **Avg. Two-Axle Wheelbase:** 9.6 ft.
Peak Hour, 12:00 AM - 12:00 PM 11:00 AM Volume: 8 Factor: 0.5
Peak Hour, 12:00 PM - 12:00 AM 1:15 PM Volume: 17 Factor: 0.47
Speed (mph) **Average:** 19.4 **Percentiles:** **10%:** 13.5 **15%:** 14.1 **50%:** 18.7 **85%:** 24.6 **90%:** 25.9

Thursday 12/01/2011
Vehicles: 103 — **% Axles Used** A: 96.9 B: 92.2
Avg. Axles Per Vehicle: 2.02 — **Avg. Two-Axle Wheelbase:** 9.4 ft.
Peak Hour, 12:00 AM - 12:00 PM 10:45 AM Volume: 10 Factor: 0.5
Peak Hour, 12:00 PM - 12:00 AM 1:30 PM Volume: 26 Factor: 0.41
Speed (mph) **Average:** 20.4 **Percentiles:** **10%:** 9.2 **15%:** 15.0 **50%:** 20.0 **85%:** 25.0 **90%:** 26.4

Friday 12/02/2011
Vehicles: 95 — **% Axles Used** A: 95.7 B: 95.7
Avg. Axles Per Vehicle: 2.00 — **Avg. Two-Axle Wheelbase:** 10.0 ft.
Peak Hour, 12:00 AM - 12:00 PM 3:15 AM Volume: 8 Factor: 1.0
Peak Hour, 12:00 PM - 12:00 AM 12:45 PM Volume: 18 Factor: 0.56
Speed (mph) **Average:** 19.9 **Percentiles:** **10%:** 12.7 **15%:** 13.9 **50%:** 19.0 **85%:** 24.6 **90%:** 25.9

Saturday 12/03/2011
Vehicles: 63 — **% Axles Used** A: 85.2 B: 83.9
Avg. Axles Per Vehicle: 2.00 — **Avg. Two-Axle Wheelbase:** 10.1 ft.
Peak Hour, 12:00 AM - 12:00 PM 2:30 AM Volume: 6 Factor: 0.38
Peak Hour, 12:00 PM - 12:00 AM 3:15 PM Volume: 13 Factor: 0.36
Speed (mph) **Average:** 19.7 **Percentiles:** **10%:** 12.4 **15%:** 13.1 **50%:** 19.6 **85%:** 24.8 **90%:** 25.5

Sunday 12/04/2011
Vehicles: 45 — **% Axles Used** A: 92.7 B: 82.6
Avg. Axles Per Vehicle: 2.00 — **Avg. Two-Axle Wheelbase:** 11.8 ft.
Peak Hour, 12:00 AM - 12:00 PM 10:45 AM Volume: 9 Factor: 0.56
Peak Hour, 12:00 PM - 12:00 AM 4:30 PM Volume: 8 Factor: 1.0
Speed (mph) **Average:** 20.2 **Percentiles:** **10%:** 7.9 **15%:** 13.2 **50%:** 21.9 **85%:** 25.7 **90%:** 25.7

Order # : 11-28-3
Street Ref. # : River AV-S end
From - To : S River Rd. to 1st turn

Site: River AV-S end
S. River Rd (s. of Riverside Dr.)

Channels: Volume — A Tube, B Tube
Speed — Near lane flow, Far lane flow
Classification — Near lane flow, Far lane flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Monday	**Vehicles:** 76										**% Axles Used**	A: 93.2	B: 88.3		
12/05/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:**			9.6 ft.	
	Peak Hour, 12:00 AM - 12:00 PM										10:30 AM	Volume: 8		Factor: 0.5	
	Peak Hour, 12:00 PM - 12:00 AM										3:00 PM	Volume: 15		Factor: 0.75	
Speed (mph)	**Average:** 20.1			**Percentiles:**		**10%:** 13.7		**15%:** 14.8		**50%:** 20.3		**85%:** 22.6		**90%:** 23.5	
Class (%)		0.0	79.4	11.8	0.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 34														

Tuesday	**Vehicles:** 16										**% Axles Used**	A: 94.7	B: 94.7		
12/06/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:**			10.5 ft.	
	Peak Hour, 12:00 AM - 12:00 PM										12:00 AM	Volume: 6		Factor: 0.38	
Speed (mph)	**Average:** 21.0			**Percentiles:**		**10%:** 6.0		**15%:** 6.0		**50%:** 20.3		**85%:** 26.4		**90%:** 27.6	
Class (%)		0.0	55.6	11.1	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 9														

Order # : 12-8-11
Street Ref. # : S Pacific Av
From - To : Hazel to Willow

Site: S Pacific Av
S. Pacific (btw Hazel and Willow)

Channels
Volume — A Tube, B Tube
Speed — Near lane flow, Far lane flow
Classification — Near lane flow, Far lane flow

Bins / Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclassified
Thursday 12/08/2011	**Vehicles:** 1426							**% Axles Used**	A: 99.2	B: 98.8				
	Avg. Axles Per Vehicle: 2.04							**Avg. Two-Axle Wheelbase:**					9.8 ft.	
	Peak Hour, 12:00 PM - 12:00 AM							4:15 PM	Volume: 355				Factor: 0.79	
Speed (mph)	**Average:** 31.5	**Percentiles:**	**10%:** 26.1	**15%:** 27.1	**50%:** 31.4	**85%:** 35.9	**90%:** 37.2							
Class (%)	0.3	66.6	24.3	0.7	6.5	0.7	0.0	0.4	0.3	0.0	0.0	0.0	0.1	0.0
	Total 688													
Friday 12/09/2011	**Vehicles:** 3267							**% Axles Used**	A: 98.3	B: 98.1				
	Avg. Axles Per Vehicle: 2.03							**Avg. Two-Axle Wheelbase:**					10.0 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							10:30 AM	Volume: 190				Factor: 0.82	
	Peak Hour, 12:00 PM - 12:00 AM							4:45 PM	Volume: 360				Factor: 0.98	
Speed (mph)	**Average:** 31.2	**Percentiles:**	**10%:** 25.9	**15%:** 26.8	**50%:** 31.0	**85%:** 35.5	**90%:** 36.8							
Class (%)	0.1	64.1	26.0	0.9	7.4	0.4	0.1	0.6	0.3	0.1	0.0	0.0	0.0	0.0
	Total 1568													
Saturday 12/10/2011	**Vehicles:** 2217							**% Axles Used**	A: 99.5	B: 99.5				
	Avg. Axles Per Vehicle: 2.02							**Avg. Two-Axle Wheelbase:**					9.7 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							11:00 AM	Volume: 126				Factor: 0.83	
	Peak Hour, 12:00 PM - 12:00 AM							5:15 PM	Volume: 222				Factor: 0.93	
Speed (mph)	**Average:** 31.3	**Percentiles:**	**10%:** 25.5	**15%:** 26.6	**50%:** 31.4	**85%:** 35.9	**90%:** 37.2							
Class (%)	0.0	73.4	20.8	0.1	5.2	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
	Total 1089													
Sunday 12/11/2011	**Vehicles:** 1469							**% Axles Used**	A: 99.5	B: 99.2				
	Avg. Axles Per Vehicle: 2.01							**Avg. Two-Axle Wheelbase:**					9.6 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							11:00 AM	Volume: 92				Factor: 0.77	
	Peak Hour, 12:00 PM - 12:00 AM							5:30 PM	Volume: 149				Factor: 0.75	
Speed (mph)	**Average:** 31.5	**Percentiles:**	**10%:** 25.5	**15%:** 26.8	**50%:** 31.4	**85%:** 36.3	**90%:** 37.2							
Class (%)	0.7	73.3	20.9	0.3	4.4	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	Total 724													
Monday 12/12/2011	**Vehicles:** 2904							**% Axles Used**	A: 98.4	B: 98.1				
	Avg. Axles Per Vehicle: 2.06							**Avg. Two-Axle Wheelbase:**					10.0 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							10:00 AM	Volume: 203				Factor: 0.78	
	Peak Hour, 12:00 PM - 12:00 AM							4:00 PM	Volume: 308				Factor: 0.9	
Speed (mph)	**Average:** 30.5	**Percentiles:**	**10%:** 24.4	**15%:** 25.7	**50%:** 30.4	**85%:** 35.0	**90%:** 36.3							
Class (%)	0.3	62.7	24.9	0.9	9.1	0.5	0.1	0.7	0.5	0.4	0.0	0.0	0.1	0.0
	Total 1372													
Tuesday 12/13/2011	**Vehicles:** 3081							**% Axles Used**	A: 98.7	B: 98.5				
	Avg. Axles Per Vehicle: 2.04							**Avg. Two-Axle Wheelbase:**					10.0 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							10:45 AM	Volume: 213				Factor: 0.86	
	Peak Hour, 12:00 PM - 12:00 AM							5:00 PM	Volume: 337				Factor: 0.77	
Speed (mph)	**Average:** 30.8	**Percentiles:**	**10%:** 25.0	**15%:** 26.4	**50%:** 31.0	**85%:** 35.5	**90%:** 36.3							
Class (%)	0.3	63.3	24.5	0.9	9.6	0.5	0.1	0.5	0.2	0.1	0.0	0.0	0.0	0.0
	Total 1483													
Wednesday 12/14/2011	**Vehicles:** 2975							**% Axles Used**	A: 99.1	B: 98.5				
	Avg. Axles Per Vehicle: 2.05							**Avg. Two-Axle Wheelbase:**					10.1 ft.	
	Peak Hour, 12:00 AM - 12:00 PM							9:00 AM	Volume: 219				Factor: 0.77	
	Peak Hour, 12:00 PM - 12:00 AM							4:15 PM	Volume: 322				Factor: 0.83	
Speed (mph)	**Average:** 30.8	**Percentiles:**	**10%:** 25.0	**15%:** 26.4	**50%:** 30.7	**85%:** 35.5	**90%:** 36.3							
Class (%)	0.2	61.4	25.7	0.8	9.4	0.8	0.2	0.7	0.8	0.1	0.0	0.0	0.0	0.0
	Total 1423													

Order # : 12-8-11
Street Ref. # : S Pacific Av
From - To : Hazel to Willow

Site: S Pacific Av
S. Pacific (btw Hazel and Willow)

Channels
Volume A Tube, B Tube
Speed Near lane flow, Far lane flow
Classification Near lane flow, Far lane flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Thursday	**Vehicles:** 548								**% Axles Used**	A: 98.9	B: 98.7				
12/15/2011	**Avg. Axles Per Vehicle:** 2.04								**Avg. Two-Axle Wheelbase:**				9.9 ft.		
	Peak Hour, 12:00 AM - 12:00 PM								8:45 AM	Volume: 195			Factor: 0.96		
Speed (mph)	**Average:** 31.0			**Percentiles:**		**10%:** 25.0		**15%:** 26.6		**50%:** 30.4		**85%:** 35.5		**90%:** 36.8	
Class (%)		0.0	66.8	21.5	0.8	9.1	1.1	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
	Total 265														

Order # : 11-28
Street Ref. # : S river Rd
From - To : S Pacific to corner

Site: S river Rd
S. River (btw Pacific and Riverside Dr)

Channels: Volume — A Tube, B Tube
Speed — Near Lane Flow, Far Lane Flow
Classification — Near Lane Flow, Far Lane Flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Monday	**Vehicles:** 449									**% Axles Used**	A: 99.5	B: 98.0			
11/28/2011	**Avg. Axles Per Vehicle:** 2.02									**Avg. Two-Axle Wheelbase:**			9.7 ft.		
	Peak Hour, 12:00 PM - 12:00 AM									4:45 PM	Volume: 126		Factor: 0.85		
Speed (mph)	**Average:** 22.0	**Percentiles:**	**10%:** 17.4	**15%:** 18.5	**50%:** 22.4	**85%:** 25.7	**90%:** 25.9								
Class (%)		0.0	70.5	21.2	0.5	6.0	0.5	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
	Total 217														
Tuesday	**Vehicles:** 1180									**% Axles Used**	A: 98.2	B: 96.7			
11/29/2011	**Avg. Axles Per Vehicle:** 2.03									**Avg. Two-Axle Wheelbase:**			9.7 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									8:30 AM	Volume: 71		Factor: 0.74		
	Peak Hour, 12:00 PM - 12:00 AM									3:15 PM	Volume: 136		Factor: 0.85		
Speed (mph)	**Average:** 22.4	**Percentiles:**	**10%:** 17.5	**15%:** 18.5	**50%:** 22.6	**85%:** 25.9	**90%:** 26.6								
Class (%)		0.0	71.1	20.2	0.7	6.6	0.7	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
	Total 560														
Wednesday	**Vehicles:** 1369									**% Axles Used**	A: 99.1	B: 97.6			
11/30/2011	**Avg. Axles Per Vehicle:** 2.02									**Avg. Two-Axle Wheelbase:**			9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									9:00 AM	Volume: 91		Factor: 0.78		
	Peak Hour, 12:00 PM - 12:00 AM									1:15 PM	Volume: 148		Factor: 0.84		
Speed (mph)	**Average:** 22.7	**Percentiles:**	**10%:** 18.2	**15%:** 19.0	**50%:** 22.7	**85%:** 26.4	**90%:** 27.3								
Class (%)		0.0	68.0	23.5	0.9	6.5	0.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	Total 659														
Thursday	**Vehicles:** 1444									**% Axles Used**	A: 98.9	B: 98.1			
12/01/2011	**Avg. Axles Per Vehicle:** 2.02									**Avg. Two-Axle Wheelbase:**			9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									11:00 AM	Volume: 140		Factor: 0.66		
	Peak Hour, 12:00 PM - 12:00 AM									3:30 PM	Volume: 181		Factor: 0.81		
Speed (mph)	**Average:** 22.8	**Percentiles:**	**10%:** 18.2	**15%:** 19.3	**50%:** 23.1	**85%:** 26.4	**90%:** 26.8								
Class (%)		0.0	67.5	25.1	0.3	5.9	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
	Total 693														
Friday	**Vehicles:** 1447									**% Axles Used**	A: 99.0	B: 97.7			
12/02/2011	**Avg. Axles Per Vehicle:** 2.03									**Avg. Two-Axle Wheelbase:**			10.0 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									9:15 AM	Volume: 111		Factor: 0.9		
	Peak Hour, 12:00 PM - 12:00 AM									3:30 PM	Volume: 184		Factor: 0.82		
Speed (mph)	**Average:** 23.0	**Percentiles:**	**10%:** 19.0	**15%:** 19.7	**50%:** 23.1	**85%:** 26.4	**90%:** 26.8								
Class (%)		0.0	62.5	27.6	0.3	8.7	0.3	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0
	Total 691														
Saturday	**Vehicles:** 1177									**% Axles Used**	A: 99.0	B: 96.4			
12/03/2011	**Avg. Axles Per Vehicle:** 2.03									**Avg. Two-Axle Wheelbase:**			9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									9:30 AM	Volume: 92		Factor: 0.62		
	Peak Hour, 12:00 PM - 12:00 AM									3:15 PM	Volume: 135		Factor: 0.6		
Speed (mph)	**Average:** 22.8	**Percentiles:**	**10%:** 18.5	**15%:** 19.3	**50%:** 22.9	**85%:** 26.6	**90%:** 27.3								
Class (%)		0.0	70.1	21.6	0.9	6.6	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0
	Total 561														
Sunday	**Vehicles:** 1096									**% Axles Used**	A: 98.3	B: 97.2			
12/04/2011	**Avg. Axles Per Vehicle:** 2.02									**Avg. Two-Axle Wheelbase:**			9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM									10:15 AM	Volume: 74		Factor: 0.77		
	Peak Hour, 12:00 PM - 12:00 AM									4:00 PM	Volume: 142		Factor: 0.74		
Speed (mph)	**Average:** 23.0	**Percentiles:**	**10%:** 18.9	**15%:** 19.7	**50%:** 23.1	**85%:** 25.9	**90%:** 26.8								
Class (%)		0.6	69.4	20.8	1.0	7.5	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
	Total 523														

Order # : 11-28
Street Ref. # : S river Rd
From - To : S Pacific to corner

Site: S river Rd
S. River (btw Pacific and Riverside Dr)

Channels
Volume A Tube, B Tube
Speed Near Lane Flow, Far Lane Flow
Classification Near Lane Flow, Far Lane Flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Monday 12/05/2011	**Vehicles:** 1400								**% Axles Used** A: 98.2 B: 97.3						
	Avg. Axles Per Vehicle: 2.04								**Avg. Two-Axle Wheelbase:**				9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM								9:45 AM Volume: 120				Factor: 0.86		
	Peak Hour, 12:00 PM - 12:00 AM								3:30 PM Volume: 198				Factor: 0.85		
Speed (mph)	**Average:** 22.8		**Percentiles:**		**10%:** 18.6		**15%:** 19.5		**50%:** 23.1		**85%:** 26.1		**90%:** 26.8		
Class (%)		0.0	66.8	24.6	0.3	6.9	0.6	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.0
	Total 663														
Tuesday 12/06/2011	**Vehicles:** 147								**% Axles Used** A: 99.4 B: 98.8						
	Avg. Axles Per Vehicle: 2.03								**Avg. Two-Axle Wheelbase:**				9.8 ft.		
	Peak Hour, 12:00 AM - 12:00 PM								7:45 AM Volume: 47				Factor: 0.73		
Speed (mph)	**Average:** 22.6		**Percentiles:**		**10%:** 16.8		**15%:** 18.7		**50%:** 22.4		**85%:** 26.8		**90%:** 27.3		
Class (%)		0.0	71.8	17.9	1.3	7.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 78														

Order # : 211-28
Street Ref. # : Mill St
From - To : S Pacific to RR Tracks

Site: Mill St
Mill (btw 3rd and Pacific)

Channels: Volume — A Tube, B Tube
Speed — Near lane flow, Far lane flow
Classification — Near lane flow, Far lane flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Monday	**Vehicles:** 244										**% Axles Used** A: 86.3 B: 60.7				
11/28/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:** 9.8 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										6:30 AM Volume: 43			Factor: 0.49	
	Peak Hour, 12:00 PM - 12:00 AM										12:00 PM Volume: 22			Factor: 0.42	
Speed (mph)	**Average:** 14.6 **Percentiles:**						**10%:** 9.0		**15%:** 9.8		**50%:** 13.8		**85%:** 18.3		**90%:** 18.7
Class (%)		1.2	52.4	41.5	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 82														
Tuesday	**Vehicles:** 383										**% Axles Used** A: 92.8 B: 65.0				
11/29/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:** 9.8 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										9:00 AM Volume: 51			Factor: 0.75	
	Peak Hour, 12:00 PM - 12:00 AM										12:30 PM Volume: 23			Factor: 0.52	
Speed (mph)	**Average:** 13.9 **Percentiles:**						**10%:** 7.8		**15%:** 9.3		**50%:** 13.1		**85%:** 18.4		**90%:** 20.0
Class (%)		2.8	61.7	27.7	2.1	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 141														
Wednesday	**Vehicles:** 543										**% Axles Used** A: 91.0 B: 64.8				
11/30/2011	**Avg. Axles Per Vehicle:** 2.01										**Avg. Two-Axle Wheelbase:** 9.6 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										5:30 AM Volume: 54			Factor: 0.84	
	Peak Hour, 12:00 PM - 12:00 AM										12:00 PM Volume: 24			Factor: 0.67	
Speed (mph)	**Average:** 14.3 **Percentiles:**						**10%:** 8.1		**15%:** 9.8		**50%:** 14.3		**85%:** 18.5		**90%:** 19.5
Class (%)		0.0	65.5	29.9	0.0	3.6	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	Total 197														
Thursday	**Vehicles:** 532										**% Axles Used** A: 90.5 B: 63.5				
12/01/2011	**Avg. Axles Per Vehicle:** 2.01										**Avg. Two-Axle Wheelbase:** 9.8 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										7:00 AM Volume: 61			Factor: 0.8	
	Peak Hour, 12:00 PM - 12:00 AM										10:00 PM Volume: 35			Factor: 0.67	
Speed (mph)	**Average:** 14.3 **Percentiles:**						**10%:** 7.9		**15%:** 9.5		**50%:** 13.9		**85%:** 18.9		**90%:** 20.0
Class (%)		2.1	53.4	38.1	1.1	4.2	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0
	Total 189														
Friday	**Vehicles:** 578										**% Axles Used** A: 91.3 B: 63.9				
12/02/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:** 9.9 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										8:15 AM Volume: 74			Factor: 0.58	
	Peak Hour, 12:00 PM - 12:00 AM										12:00 PM Volume: 18			Factor: 0.64	
Speed (mph)	**Average:** 14.6 **Percentiles:**						**10%:** 10.0		**15%:** 10.5		**50%:** 14.4		**85%:** 18.3		**90%:** 20.0
Class (%)		1.0	56.7	35.2	0.5	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 210														
Saturday	**Vehicles:** 395										**% Axles Used** A: 88.6 B: 63.6				
12/03/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:** 9.9 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										9:15 AM Volume: 49			Factor: 0.64	
	Peak Hour, 12:00 PM - 12:00 AM										12:00 PM Volume: 39			Factor: 0.75	
Speed (mph)	**Average:** 14.5 **Percentiles:**						**10%:** 9.7		**15%:** 10.5		**50%:** 14.3		**85%:** 18.1		**90%:** 19.2
Class (%)		0.0	56.4	38.6	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 140														
Sunday	**Vehicles:** 437										**% Axles Used** A: 84.1 B: 60.2				
12/04/2011	**Avg. Axles Per Vehicle:** 2.00										**Avg. Two-Axle Wheelbase:** 9.6 ft.				
	Peak Hour, 12:00 AM - 12:00 PM										5:45 AM Volume: 46			Factor: 0.46	
	Peak Hour, 12:00 PM - 12:00 AM										11:00 PM Volume: 30			Factor: 0.47	
Speed (mph)	**Average:** 14.3 **Percentiles:**						**10%:** 8.5		**15%:** 9.7		**50%:** 13.9		**85%:** 18.5		**90%:** 19.1
Class (%)		0.7	65.1	30.1	0.7	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 146														

Order # : 211-28
Street Ref. # : Mill St
From - To : S Pacific to RR Tracks

Site: Mill St
Mill (btw 3rd and Pacific)

Channels Volume A Tube, B Tube
Speed Near lane flow, Far lane flow
Classification Near lane flow, Far lane flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Monday	**Vehicles:** 473								**% Axles Used** A: 88.6 B: 68.6						
12/05/2011	**Avg. Axles Per Vehicle:** 2.01								**Avg. Two-Axle Wheelbase:** 9.7 ft.						
	Peak Hour, 12:00 AM - 12:00 PM								7:15 AM Volume: 55 Factor: 0.81						
	Peak Hour, 12:00 PM - 12:00 AM								12:45 PM Volume: 26 Factor: 0.54						
Speed (mph)	**Average:** 14.8 **Percentiles:** **10%:** 8.4 **15%:** 9.7 **50%:** 14.7 **85%:** 18.7 **90%:** 19.9														
Class (%)		2.9	56.3	32.2	0.6	7.5	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
	Total 174														
Tuesday	**Vehicles:** 9								**% Axles Used** A: 75.0 B: 66.7						
12/06/2011	**Avg. Axles Per Vehicle:** 2.00								**Avg. Two-Axle Wheelbase:** 9.5 ft.						
Speed (mph)	**Average:** 14.3 **Percentiles:** **10%:** 7.6 **15%:** 7.6 **50%:** 7.6 **85%:** 15.8 **90%:** 15.8														
Class (%)		0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 3														

Order # : 12-2
Street Ref. # : River Av-N end
From - To : RR tracks to corner

Site: River Av-N end
Riverside Dr/Mill (w. of RR tracks)

Channels Volume A Tube, B Tube
Speed Near Lane Flow, Far Lane Flow
Classification Near Lane Flow, Far Lane Flow

Bins Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Friday 12/02/2011	**Vehicles:** 115							**% Axles Used**		A: 78.9	B: 76.8			
	Avg. Axles Per Vehicle: 2.00							**Avg. Two-Axle Wheelbase:**				9.7 ft.		
	Peak Hour, 12:00 PM - 12:00 AM							4:30 PM		Volume: 39		Factor: 0.36		
Speed (mph)	**Average:** 14.7		**Percentiles:**		**10%:** 10.1		**15%:** 11.0		**50%:** 14.6		**85%:** 17.5		**90%:** 18.1	
Class (%)	0.0	60.5	37.2	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 43													
Saturday 12/03/2011	**Vehicles:** 199							**% Axles Used**		A: 80.0	B: 88.9			
	Avg. Axles Per Vehicle: 2.00							**Avg. Two-Axle Wheelbase:**				10.0 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							10:00 AM		Volume: 19		Factor: 0.47		
	Peak Hour, 12:00 PM - 12:00 AM							3:00 PM		Volume: 31		Factor: 0.78		
Speed (mph)	**Average:** 14.6		**Percentiles:**		**10%:** 9.3		**15%:** 10.9		**50%:** 15.1		**85%:** 17.8		**90%:** 18.6	
Class (%)	0.0	60.0	32.5	1.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 80													
Sunday 12/04/2011	**Vehicles:** 128							**% Axles Used**		A: 80.6	B: 84.0			
	Avg. Axles Per Vehicle: 2.00							**Avg. Two-Axle Wheelbase:**				9.4 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							9:15 AM		Volume: 17		Factor: 0.71		
	Peak Hour, 12:00 PM - 12:00 AM							3:00 PM		Volume: 15		Factor: 0.54		
Speed (mph)	**Average:** 16.3		**Percentiles:**		**10%:** 12.6		**15%:** 13.2		**50%:** 16.3		**85%:** 18.9		**90%:** 19.2	
Class (%)	0.0	76.0	20.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 50													
Monday 12/05/2011	**Vehicles:** 193							**% Axles Used**		A: 91.1	B: 87.7			
	Avg. Axles Per Vehicle: 2.00							**Avg. Two-Axle Wheelbase:**				9.7 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							9:30 AM		Volume: 19		Factor: 0.43		
	Peak Hour, 12:00 PM - 12:00 AM							3:30 PM		Volume: 26		Factor: 0.5		
Speed (mph)	**Average:** 14.6		**Percentiles:**		**10%:** 9.7		**15%:** 10.8		**50%:** 15.2		**85%:** 17.5		**90%:** 18.5	
Class (%)	0.0	69.5	22.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 82													
Tuesday 12/06/2011	**Vehicles:** 216							**% Axles Used**		A: 88.2	B: 85.6			
	Avg. Axles Per Vehicle: 2.01							**Avg. Two-Axle Wheelbase:**				9.9 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							11:00 AM		Volume: 23		Factor: 0.57		
	Peak Hour, 12:00 PM - 12:00 AM							4:00 PM		Volume: 33		Factor: 0.75		
Speed (mph)	**Average:** 14.5		**Percentiles:**		**10%:** 8.7		**15%:** 10.0		**50%:** 14.6		**85%:** 18.1		**90%:** 18.9	
Class (%)	0.0	61.8	24.7	0.0	12.4	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0
	Total 89													
Wednesday 12/07/2011	**Vehicles:** 191							**% Axles Used**		A: 79.8	B: 87.2			
	Avg. Axles Per Vehicle: 2.00							**Avg. Two-Axle Wheelbase:**				9.9 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							7:00 AM		Volume: 10		Factor: 0.63		
	Peak Hour, 12:00 PM - 12:00 AM							2:45 PM		Volume: 26		Factor: 0.81		
Speed (mph)	**Average:** 15.0		**Percentiles:**		**10%:** 10.0		**15%:** 10.3		**50%:** 15.0		**85%:** 18.3		**90%:** 19.6	
Class (%)	0.0	58.7	28.0	0.0	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total 75													
Thursday 12/08/2011	**Vehicles:** 349							**% Axles Used**		A: 87.4	B: 86.1			
	Avg. Axles Per Vehicle: 2.03							**Avg. Two-Axle Wheelbase:**				9.9 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							9:45 AM		Volume: 23		Factor: 0.72		
	Peak Hour, 12:00 PM - 12:00 AM							4:45 PM		Volume: 102		Factor: 0.88		
Speed (mph)	**Average:** 15.0		**Percentiles:**		**10%:** 11.2		**15%:** 11.9		**50%:** 15.0		**85%:** 17.7		**90%:** 18.3	
Class (%)	0.0	61.1	28.5	0.7	9.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
	Total 144													

Order # : 12-2
Street Ref. # : River Av-N end
From - To : RR tracks to corner

Site: River Av-N end
Riverside Dr/Mill (w. of RR tracks)

Channels
Volume A Tube, B Tube
Speed Near Lane Flow, Far Lane Flow
Classification Near Lane Flow, Far Lane Flow

Bins	Class	Bike	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Doubl	5 Axle Doubl	>6 Axl Doubl	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Unclas ified
Friday	**Vehicles:** 144							**% Axles Used**	A: 76.8	B: 73.1					
12/09/2011	**Avg. Axles Per Vehicle:** 2.00							**Avg. Two-Axle Wheelbase:**					9.7 ft.		
	Peak Hour, 12:00 AM - 12:00 PM							10:45 AM		Volume: 26			Factor: 0.72		
	Peak Hour, 12:00 PM - 12:00 AM							12:15 PM		Volume: 30			Factor: 0.75		
Speed (mph)	**Average:** 15.4	**Percentiles:**	**10%:** 10.8	**15%:** 11.8	**50%:** 15.5	**85%:** 18.4	**90%:** 18.9								
Class (%)	0.0	58.5	30.2	0.0	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Total 53														

South Kelso Railroad Crossing Study

Traffic Analysis

Appendix D-2: Crash Data

Reported collisions that occurred on or in the vicinity of S Pacific Ave, S River Rd, Mill St, Hazel St and Riverside Dr within Kelso.....1/1/06 - 12/31/10
*As of 1/1/2009 citizen reports are no longer being captured (Report # begins with "C")

	JURISDICTION	PRIMARY TRAFFICWAY	BLOCK No	MILE POST	INTERSECTING TRAFFICWAY	DIST FROM REF POINT	MI or FT	COMP DIR FROM REF POINT	REFERENCE POINT NAME	DATE	YEAR	TIME	*REPORT NUMBER	#VEH	#PEDS	#PEDAL	# INJ	#FAT	MOST SEVERE INJURY TYPE	MOST SEVERE SOBRIETY TYPE	WORKZONE	FIRST COLLISION TYPE	SECOND COLLISION TYPE / OBJECT STRUCK
13	City Street	MILL ST			S PACIFIC AVE					05/18/07	2007	5:42 PM	2439329	2			0	0	No Injury	Had NOT Been Drinking	ANGL	Entering at angle	
15	City Street	MILL ST	200		S PACIFIC AVE	111	F	E	S PACIFIC AV	09/20/06	2006	3:17 PM	2680727	2			0	0	No Injury	Had NOT Been Drinking	SS-M	One parked--one moving	
18	City Street	S PACIFIC AVI	1400		YEW ST					09/06/06	2006	4:29 PM	2439553	2			0	0	No Injury	Had NOT Been Drinking	SS-O	From opposite direction - both going straight - sideswipe	
19	City Street	S PACIFIC AVI	900		MILL ST					04/17/09	2009	1:44 PM	E018063	2			1	0	Possible Injury	Had NOT Been Drinking	REAR	From same direction - both going straight - one stopped - rear-end	
23	City Street	S PACIFIC AVE			S RIVER RD					12/18/08	2008	10:49 AM	2673887	2			0	0	No Injury	Had NOT Been Drinking	ANGL	Entering at angle	
25	City Street	S PACIFIC AVE			YEW ST					07/23/07	2007	11:01 PM	2673778	2			0	0	No Injury	Had NOT Been Drinking	SS-O	From opposite direction - both going straight - sideswipe	
26	City Street	S PACIFIC AVE			YEW ST					05/13/09	2009	12:58 PM	3124108	2			0	0	No Injury	Had NOT Been Drinking	REAR	From same direction - both going straight - one stopped - rear-end	
28	City Street	S PACIFIC AVE			MILL ST					05/06/09	2009	3:03 AM	E019092	2			1	0	Possible Injury	Unknown	ANGL	Entering at angle	
30	City Street	S PACIFIC AVI	1100		MILL ST					09/08/08	2008	1:47 PM	2674234	2			1	0	Possible Injury	Unknown	REAR	From same direction - both going straight - one stopped - rear-end	
33	City Street	S PACIFIC AVE			MILL ST					10/19/09	2009	1:00 PM	3124483	2			0	0	No Injury	Had NOT Been Drinking	SS-O	From opposite direction - one left turn - one straight	
35	City Street	S RIVER RD	1400		RIVERSIDE DR	200	F	W	RIVERSIDE DR	10/26/07	2007	4:09 PM	2439422	2			1	0	Serious Injury	Had NOT Been Drinking	OTH	From opposite direction - all others	
37	City Street	S RIVER RD			RR CROSSING					10/27/07	2007	1:01 PM	2439423	2			0	0	No Injury	Had NOT Been Drinking	NCOL	All other non-collision	
41	City Street	S RIVER RD			RIVERSIDE DR	100	F	W	RIVERSIDE DR	11/21/08	2008	12:01 AM	2674261	1			0	0	No Injury	Unknown	FIX	Fixed object	Over Embankment - No Guardrail Present
42	City Street	S RIVER RD	1300		RR CROSSING					04/05/10	2010	12:19 PM	E048017	1			0	0	No Injury	Had NOT Been Drinking	FIX	Fixed object	
44	City Street	S RIVER RD	1300		RR CROSSING					08/06/08	2008	7:13 AM	2674482	1			0	0	No Injury	Had NOT Been Drinking	FIX	Fixed object	
45	City Street	S RIVER RD	1400		RIVERSIDE DR					07/25/09	2009	5:35 PM	2674470	1			0	0	No Injury	Had NOT Been Drinking	FIX	Fixed object	

	JUNCTION RELATIONSHIP	ROADWAY SURFACE	LIGHTING CONDITIONS	WEATHER	VEHICLE 1 TYPE	VEH 1 COMP DIR FROM	VEH 1 COMP DIR TO	VEH 1 ACTION
13	At Intersection and Related	Dry	Daylight	Clear or Partly Cloudy	Passenger Car	West	East	Going Straight Ahead
15	Intersection Related but Not at Intersection	Dry	Daylight	Raining	Passenger Car	North	East	Making Left Turn
18	Not at Intersection and Not Related	Dry	Daylight	Clear or Partly Cloudy	Pickup,Panel Truck or Vanette under 10,000 lb	North	South	Going Straight Ahead
19	At Intersection and Related	Wet	Daylight	Clear or Partly Cloudy	Passenger Car	North	South	Going Straight Ahead
23	At Intersection and Related	Snow/Slush	Daylight	Snowing	Pickup,Panel Truck or Vanette under 10,000 lb	Southwest	Northeast	Going Straight Ahead
25	At Intersection and Not Related	Dry	Dawn	Clear or Partly Cloudy	Passenger Car	South	North	Going Straight Ahead
26	At Intersection and Related	Dry	Daylight	Clear or Partly Cloudy	Pickup,Panel Truck or Vanette under 10,000 lb	North	Vehicle Stopped	Stopped for Traffic
28	At Intersection and Related	Wet	Dark-Street Lights On	Raining	Passenger Car	South	East	Making Right Turn
30	At Intersection and Related	Dry	Daylight	Clear or Partly Cloudy	Pickup,Panel Truck or Vanette under 10,000 lb	South	North	Going Straight Ahead
33	At Intersection and Related	Dry	Daylight	Overcast	Passenger Car	South	West	Making Left Turn
35	Not at Intersection and Not Related	Dry	Daylight	Clear or Partly Cloudy	Passenger Car	Southwest	Northeast	Going Straight Ahead
37	At Intersection and Related	Dry	Daylight	Clear or Partly Cloudy	Pickup,Panel Truck or Vanette under 10,000 lb	Northeast	Vehicle Stopped	Stopped in Roadway
41	Not at Intersection and Not Related	Wet	Unknown	Unknown	Pickup,Panel Truck or Vanette under 10,000 lb	Southwest	East	Going Straight Ahead
42	At Intersection and Related	Wet	Daylight	Raining	Passenger Car	Southeast	Northwest	Going Straight Ahead
44	At Intersection and Related	Dry	Daylight	Clear or Partly Cloudy	Pickup,Panel Truck or Vanette under 10,000 lb	Northeast	Southwest	Starting in Traffic Lane
45	Not at Intersection and Not Related	Dry	Daylight	Clear or Partly Cloudy	Passenger Car	South	East	Going Straight Ahead

	MV DRIVER CONT CIRC 1 (UNIT 1)	MV DRIVER CONT CIRC 2 (UNIT 1)	MV DRIVE CONT CIRC 3 (UNIT 1)	VEHICLE 2 TYPE	VEH 2 COMP DIR FROM	VEH 2 COMP DIR TO	VEH 2 ACTION	MV DRIVER CONT CIRC 1 (UNIT 2)	MV DRIVER CONT CIRC 2 (UNIT 2)
13	None			Passenger Car	North	South	Starting in Traffic Lane	Did Not Grant RW to Vehicle	
15	Exceeding Reas. Safe Speed			Pickup,Panel Truck or Vanette under 10,000 lb			Legally Parked, Unoccupied		
18	Driver Interacting with Passengers, Anim			Pickup,Panel Truck or Vanette under 10,000 lb	South	North	Going Straight Ahead	None	
19	Inattention	Did Not Grant RW to Vehicle	Follow Too Closely	Passenger Car	North	Vehicle Stopped	Stopped for Traffic	None	
23	None			Pickup,Panel Truck or Vanette under 10,000 lb	North	South	Going Straight Ahead	Disregard Stop Sign - Flashing Red	
25	Over Center Line			Passenger Car	North	South	Going Straight Ahead	None	
26	None			Passenger Car	North	South	Going Straight Ahead	Follow Too Closely	Other Driver Distractions Inside Vehicle
28	Improper Passing			Passenger Car	East	West	Going Straight Ahead	None	
30	Follow Too Closely			Passenger Car	South	Vehicle Stopped	Stopped for Traffic	None	
33	Did Not Grant RW to Vehicle			Pickup,Panel Truck or Vanette under 10,000 lb	North	South	Going Straight Ahead	None	
35	Exceeding Reas. Safe Speed	Over Center Line		Passenger Car	Northeast	Southwest	Going Straight Ahead	None	
37	Other			Pickup,Panel Truck or Vanette under 10,000 lb	Northeast	Southwest	Starting in Traffic Lane	Other	
41	Other								
42	Exceeding Stated Speed Limit	Over Center Line							
44	None								
45	Exceeding Reas. Safe Speed								

Annual WBAPS 2011

WEB ACCIDENT PREDICTION SYSTEM

Accident Prediction Report for
Public at-Grade Highway-Rail Crossings

Including:

Disclaimer/Abbreviation Key
Accident Prediction List
Collision History
Abbreviated Inventory Profile

Provided by:

Federal Railroad Administration
Office of Safety Analysis
Highway-Rail Crossing Safety & Trespass Prevention

Data Contained in this Report:

STATE: WA
CITY: KELSO

Date Prepared: 2/8/2012

U.S. Department
of Transportation
Federal Railroad
Administration

USING DATA PRODUCED BY WBAPS

(Web Accident Prediction System)

1200 New Jersey Avenue, SE
Third Floor West
Washington, DC 20590

WBAPS generates reports listing public highway-rail intersections for a State, County, City or railroad ranked by predicted collisions per year. These reports include brief lists of the Inventory record and the collisions over the last 10 years along with a list of contacts for further information. These data were produced by the Federal Railroad Administration's Web Accident Prediction System (WBAPS).

WBAPS is a computer model which provides the user an analytical tool, which combined with other site-specific information, can assist in determining where scarce highway-rail grade crossing resources can best be directed. This computer model does not rank crossings in terms of most to least dangerous. Use of WBAPS data in this manner is incorrect and misleading.

WBAPS provides the same reports as PCAPS, which is FRA's PC Accident Prediction System. PCAPS was originally developed as a tool to alert law enforcement and local officials of the important need to improve safety at public highway-rail intersections within their jurisdictions. It has since become an indispensable information resource which is helping the FRA, States, railroads, Operation Lifesaver and others, to raise the awareness of the potential dangers at public highway-rail intersections. The PCAPS/WBAPS output enables State and local highway and law enforcement agencies identify public highway-rail crossing locations which may require additional or specialized attention. It is also a tool which can be used by state highway authorities and railroads to nominate particular crossings which may require physical safety improvements or enhancements.

The WBAPS accident prediction formula is based upon two independent factors (variables) which includes (1) basic data about a crossing's physical and operating characteristics and (2) five years of accident history data at the crossing. These data are obtained from the FRA's inventory and accident/incident files which are subject to keypunch and submission errors. Although every attempt is made to find and correct errors, there is still a possibility that some errors still exist. Erroneous, inaccurate and non-current data will alter WBAPS accident prediction values. While approximately 100,000 inventory file changes and updates are voluntarily provided annually by States and railroads and processed by FRA into the National Inventory File, data records for specific crossings may not be completely current. Only the intended users (States and railroads) are really knowledgeable as to how current the inventory data is for a particular State, railroad, or location.

It is important to understand the type of information produced by WBAPS and the limitations on the application of the output data. WBAPS does not state that specific crossings are the most dangerous. Rather, the WBAPS data provides an indication that conditions are such that one crossing may possibly be more hazardous than another based on the specific data that is in the program. It is only one of many tools which can be used to assist individual States, railroads and local highway authorities in determining where and how to initially focus attention for improving safety at public highway-rail intersections. WBAPS is designed to nominate crossings for further evaluation based only upon the physical and operating characteristics of specific crossings as voluntarily reported and updated by States and railroads and five years of accident history data.

PCAPS and WBAPS software are not designed to single out specific crossings without considering the many other factors which may influence accident rates or probabilities. State highway planners may or may not use PCAPS/WBAPS accident prediction model. Some States utilize their own formula or model which may include other geographic and site-specific factors. At best, PCAPS and WBAPS software and data nominates crossings for further on-the-ground review by knowledgeable highway traffic engineers and specialists. The output information is not the end or final product and the WBAPS data should not be used for non-intended purposes.

It should also be noted that there are certain characteristics or factors which are not, nor can be, included in the WBAPS database. These include sight-distance, highway congestion, bus or hazardous material traffic, local topography, and passenger exposure (train or vehicle), etc. Be aware that PCAPS/WBAPS is only one model and that other accident prediction models which may be used by States may yield different, by just as valid, results for ranking crossings for safety improvements.

Finally, it should be noted that this database is not the sole indicator of the condition of a specific public highway-rail intersection. The WBAPS output must be considered as a supplement to the information needed to undertake specific actions aimed at enhancing highway-rail crossing safety at locations across the U.S. The authority and jurisdiction to appropriate resources towards the safety improvement or elimination of specific crossings lies with the individual States.

U.S. Department
of Transportation
Federal Railroad
Administration

ABBREVIATION KEY

for use with WBAPS Reports

1200 New Jersey Avenue, SE
Third Floor West
Washington, DC 20590

The lists produced are only for public at-grade highway-rail intersections for the entity listed at the top of the page. The parameters shown are those used in the collision prediction calculation.

RANK:	Crossings are listed in order and ranked with the highest collision prediction value first.
PRED COLLS:	The accident prediction value is the probability that a collision between a train and a highway vehicle will occur at the crossing in a year.
CROSSING:	The unique sight specific identifying DOT/AAR Crossing Inventory Number.
RR:	The alphabetic abbreviation for the railroad name.
CITY:	The city in (or near) which the crossing is located.
ROAD:	The name of the road, street, or highway (if provided) where the crossing is located.
NUM OF COLLISIONS:	The number of accidents reported to FRA in each of the years indicated. Note: Most recent year is partial year (data is not for the complete calendar year) unless Accidents per Year is 'AS OF DECEMBER 31'.
DATE CHG:	The date of the latest change of the warning device category at the crossing which impacts the collision prediction calculation, e.g., a change from crossbucks to flashing lights, or flashing lights to gates. The accident prediction calculation utilizes three different formulas, on each for (1) passive devices, (2) flashing lights only, and (3) flashing lights with gates. When a date is shown, the collision history prior to the indicated year-month is not included in calculating the accident prediction value.
WD:	The type of warning device shown on the current Inventory record for the crossing where: FQ=Four Quad Gates; GT = All Other Gates; FL = Flashing lights; HS = Wigwags, Highway Signals, Bells, or Other Activated; SP = Special Protection (e.g., a flagman); SS = Stop Signs; XB = Crossbucks; OS = Other Signs or Signals; NO = No Signs or Signals.
TOT TRNS:	Number of total trains per day.
TOT TRKS:	Total number of railroad tracks between the warning devices at the crossing.
TTBL SPD:	The maximum timetable (allowable) speed for trains through the crossing.
HWY PVD:	Is the highway paved on both sides of the crossing?
HWY LNS:	The number of highway traffic lanes crossing the tracks at the crossing.
AADT:	The Average Annual Daily Traffic count for highway vehicles using the crossing.

*PUBLIC HIGHWAY-RAIL CROSSINGS RANKED BY PREDICTED ACCIDENTS PER YEAR AS OF 12/31/2010**

*Num of Collisions: Most recent year is partial year (data is not for the complete calendar year) unless Accidents per Year is 'AS OF DECEMBER 31'.

RANK	PRED COLLS.	CROSSING	RR	STATE	COUNTY	CITY	ROAD	NUM OF COLLISIONS 10*	09	08	07	06	DATE CHG	WD	TOT TRN	TOT TRK	TTBL SPD	HWY PVD	HWY LNS	AADT
1	0.053383	092466V	BNSF	WA	COWLITZ	KELSO	COWLITZ GARDEN	0	0	0	0	1		GT	52	3	52	YES	2	460
2	0.017771	840542C	CLC	WA	COWLITZ	KELSO	CLARK ST	0	0	0	0	0		XB	10	1	25	YES	2	385
3	0.017771	840543J	CLC	WA	COWLITZ	KELSO	FISHERS LANE	0	0	0	0	0		XB	10	1	25	YES	2	385
4	0.016077	092458D	BNSF	WA	COWLITZ	KELSO	MILL STREET	0	0	0	0	0		GT	53	3	75	YES	2	200
5	0.014984	092457W	BNSF	WA	COWLITZ	KELSO	YEW ST.(S RIVE	0	0	0	0	0		GT	53	3	75	YES	2	150
TTL:	0.119986							0	0	0	0	1								

*PUBLIC HIGHWAY-RAIL CROSSINGS RANKED BY PREDICTED ACCIDENTS PER YEAR AS OF 12/31/2010**

*Num of Collisions: Most recent year is partial year (data is not for the complete calendar year) unless Accidents per Year is 'AS OF DECEMBER 31'.

No.	CROSSING	PRED COLLS.	RANK	STATE	COUNTY	CITY	ROAD	RR	MP
1	092457W	0.014984	5	WA	COWLITZ	KELSO	YEW ST.(S RIVE	BNSF	009798
2	092458D	0.016077	4	WA	COWLITZ	KELSO	MILL STREET	BNSF	009767
3	092466V	0.053383	1	WA	COWLITZ	KELSO	COWLITZ GARDEN	BNSF	009555
4	840542C	0.017771	2	WA	COWLITZ	KELSO	CLARK ST	CLC	000375
5	840543J	0.017771	3	WA	COWLITZ	KELSO	FISHERS LANE	CLC	000390

TTL: 0.119986 0 0 0 0 1

TEN YEAR COLLISION HISTORY AT PUBLIC AT-GRADE CROSSINGS ON THE ACCIDENT PREDICTION LIST

Crossing	Date/Time	Railroad	City/hwy	Highway User/ User Speed	Type Track/ Train Speed	Weather	Circumstances/ View of Track Obstructed	Warning Devices/ Operating?	Interc/ Lights	# Killed / # Injured
092466V										
	08/23/06	ATK		AUTO	MAIN	70 F	TRN STRUCK HWY USR	GATES	NO	0
	4:12PM		CO52590; COWLITZ GRD	000MPH	052MPH	CLEAR	NOT OBSTRUCTED	YES		0

Total Accidents: 1

Total accidents this report: 1

ABBREVIATED HIGHWAY-RAIL CROSSING INVENTORY PROFILE

Crossing	State	County	City	Highway	Railroad
092466V	WA	COWLITZ	KELSO	CO52590	BNSF

Division	Subdivision	Milepost	Train Movements
NORTHWEST	SEATTLE	0095.55	26 Day thru / 26 Night thru

Typical Train Speed	Type Development	# Traffic Lanes	Highway Paved?
From 1 to 52 MPH	1	2	1 / 3

Passive Devices	Active Devices
2 REFL XBUCK / 2 OTH STOP SIGN / 2 3-TRKS / 2 OTHRSTPSGN	4 R-W GATE

Tracks	Highway System	Function Class	AADT	% Trucks
2 MAIN / 1 SIDING	08	19	460	10

Crossing	State	County	City	Highway	Railroad
840542C	WA	COWLITZ	KELSO	CITY ST	CLC

Division	Subdivision	Milepost	Train Movements
		0003.75	6 Day thru / 4 Night thru

Typical Train Speed	Type Development	# Traffic Lanes	Highway Paved?
From 18 to 25 MPH	2	2	1 / 3

Passive Devices	Active Devices
2 REFL XBUCK	

Tracks	Highway System	Function Class	AADT	% Trucks
1 MAIN	08	19	385	07

Crossing	State	County	City	Highway	Railroad
840543J	WA	COWLITZ	KELSO	CITY ST	CLC

Division	Subdivision	Milepost	Train Movements
		0003.90	6 Day thru / 4 Night thru

Typical Train Speed	Type Development	# Traffic Lanes	Highway Paved?
From 18 to 25 MPH	2	2	1 / 1

Passive Devices	Active Devices
2 REFL XBUCK	

Tracks	Highway System	Function Class	AADT	% Trucks
1 MAIN	08	19	385	07

Crossing	State	County	City	Highway	Railroad
092458D	WA	COWLITZ	KELSO		BNSF

Division	Subdivision	Milepost	Train Movements
NORTHWEST	SEATTLE	0097.67	27 Day thru / 26 Night thru

Typical Train Speed	Type Development	# Traffic Lanes	Highway Paved?
From 1 to 75 MPH	2	2	1 / 3

Passive Devices	Active Devices
2 REFL XBUCK / 2 STD STOP SIGN / 2 3-TRKS	2 R-W GATE

Tracks	Highway System	Function Class	AADT	% Trucks
2 MAIN / 1 SIDING	08	19	200	05

Crossing	State	County	City	Highway	Railroad
092457W	WA	COWLITZ	KELSO		BNSF

Division	Subdivision	Milepost	Train Movements
NORTHWEST	SEATTLE	0097.98	27 Day thru / 26 Night thru

Typical Train Speed	Type Development	# Traffic Lanes	Highway Paved?
From 1 to 75 MPH	2	2	1 / 3

Passive Devices	Active Devices
2 REFL XBUCK / 2 OTH STOP SIGN / 2 3-TRKS / 2 OTHRSTPSGN	4 R-W GATE

Tracks	Highway System	Function Class	AADT	% Trucks
2 MAIN / 1 SPUR	08	19	150	50

Appendix E

Comprehensive Plan and Zoning Designations Environmental Justice

Summary of Consistency with Comprehensive Plan and Zoning Designations

Options 1 and 2 are the most consistent with land use policies to protect residential neighborhoods and the environment due to the shorter length of roadway. Options 3 and 4 are the least consistent with environmental policies because they would create more new impervious surface and cross more sensitive areas east of the tracks. All options are consistent with transportation goals/policies. Tables listing the comprehensive plan policies and evaluating the options against the policies is included at the end of this appendix.

Option 1 impacts industrial (ML, MH), agricultural (AG), and residential zones (RMF and RSF-10). Option 2A impacts industrial (ML, MH), agricultural (AG), commercial (C-2), and residential zones (UR, RMF and RSF-10). Option 2B impacts industrial (ML, MH), commercial (C-2), agricultural (AG), and residential zones (UR, RMF and RSF-10). Options 3 and 4 impact commercial (C-2), industrial (ILM), agricultural (AG), and residential zones (UR, RMF and RSF-10).

City of Kelso Land Use Plan Designations

The City of Kelso Land Use Map shows three designations for land uses in the study area: Retail/Office/Commercial, Industrial and Open. The land roughly north of Olive Street is designated as Retail/Office/Commercial, with the land between Olive and the unincorporated area designated Industrial. South of the unincorporated area there is a strip designated Industrial, with the remaining area designated Open.

City of Kelso Zoning Regulations

Title 17, Planning and Zoning

Transportation is listed as a use in the use table 17.15, but only with respect to parking, park and ride lots, and transit facilities. Roads are assumed to be a use allowed outright in all underlying zones.

There are some inconsistencies between existing uses, zoning, and the long range Land Use Plan map. The existing low-density residential uses and zoning designation appears to be inconsistent with the long-range Land Use Plan for the same area, which designates commercial uses. The maximum lot size in RSF-10 is 22,000 square feet, but according to the City, most of the lots in the area are on septic systems, which typically require a minimum of one acre of land to meet health district standards. Consequently, some of the parcels may be non-conforming with the zone district, or health standards, as well as the Land Use Plan. This may have implications for relocating any residences within the same area if they are displaced.

Active recreation facilities are permitted in the OPN zone as conditional uses, but only within designated public parks in the Parks Master Plan [which was not evaluated for this memorandum].

Chapter 17.30, Overlay Districts, regulates the airspace around the Kelso-Longview Airport, which lies east of the BNSF tracks, in unincorporated Cowlitz County. Section 17.30.20, Airport safety overlay, controls air space obstructions on adjoining property. Projections into the airspace, such as light poles and bridges are subject to the restrictions in the code. Representatives from the airport have indicated that 44 feet is the maximum height for structures in this area.

Chapter 17.154 governs non-conforming situations, lots, and uses. The intent allows pre-existing nonconformities to continue until they are removed by economic forces or otherwise, but not to encourage their survival except in specified cases.

The City has proposed revisions to the zoning, subdivision, and land use administration (permitting) regulations. They are expected to be adopted within the next year. The zoning code revisions as described on the City of Kelso website ("Title 17 changes—Greatest Hits) appear to be relatively minor and are not expected to impact the proposed new arterial/collector.

Title 18.04 Environmental Policy Act

State Environmental Policy Act (SEPA) clearance is required for most development projects unless they meet thresholds for exemptions. The City of Kelso primarily adopts by reference the SEPA rules in the Washington Administrative Code, Chapter 197-11. Road projects typically do not meet the exemptions under SEPA because of the amount of excavation required (more than 500 cubic yards exceeds the threshold) or development in an environmentally-sensitive area such as wetlands is proposed. A SEPA checklist should be able to demonstrate that mitigation measures could reduce impacts below 'significant' levels. In that case, the City (if lead agency) would issue a Determination of Non-significance (mitigated), meaning the project would not require an environmental impact statement.

Title 18.08 Shoreline Master Program Adopted

The city of Kelso uses Cowlitz County's shoreline management master program, adopting it by reference in Chapter 18.08 of the municipal code. (See discussion under Cowlitz County, below.)

Title 18.12 Floodplain Management

This chapter requires a development permit before construction or development begins within any area of special flood hazard established in Section 18.12.070. The areas of special flood hazard are identified by the Federal Insurance Administration and recognized by the State Department of Ecology (DOE) in a scientific and engineering report entitled "Flood Insurance Study for the City of Kelso, Washington," dated December 20, 2001 (and any revisions), with accompanying Flood Insurance Rate Maps (FIRM). Panel No. 5300330003-E shows the subject area as being within Zone X, an area protected from the 100-year flood by levees which could be subject to failure or overtopping during larger floods.

Title 18.20 Critical Areas

The City's critical areas ordinance implements the requirements of GMA for environmentally-sensitive areas, which are: critical area wetlands, fish and wildlife habitat conservation areas, frequently flooded areas, geologic hazard areas, and critical aquifer recharge areas. The ordinance requires a permit for all

development within critical areas that does not meet exemptions. Maintenance, operation, reconstruction of existing public and private roads, streets, driveways, utility lines, and existing structures are exempted provided that reconstruction of the facilities does not extend outside the previously disturbed area. None of the Kelso rail crossing project alternatives would qualify for this exemption because they all require work outside existing facilities. Applicants for development proposals supply studies or reports to determine whether any of the established categories of critical areas exist on the project site and the extent of the critical areas affected by a proposal.

Cowlitz County Comprehensive Plan Designations

An area of unincorporated Cowlitz County is roughly bounded on the north by an alignment with Hazel Street, on the south by an alignment with Douglas Street west of the BNSF tracks, and on the west by South River Road. County Comprehensive Plan Maps 34-8-2W show the area east of the tracks and south of Willow Street designated/zoned UR (Urban Residential) except for lots immediately adjacent to Pacific Avenue, where the designation is C-2 (Urban Commercial). East of the BNSF tracks the land south of Hazel Street is designated/zoned MH (Heavy Manufacturing), and north of Hazel is designated/zoned ML (Light Manufacturing). The unincorporated area between South River Road and the BNSF tracks is designated/zoned and as AG (Agriculture).

Cowlitz County Zoning Regulations

Note: The following review was compiled in 2011. As of the date of the report, the County's website does not have the zoning code available for review because it is being updated.

Title 19, Chapter 19.11, Environmental Policy

Cowlitz County adopts by reference the SEPA rules in the Washington Administrative Code, Chapter 197-11. State Environmental Policy Act (SEPA) clearance is required for most development projects unless they meet thresholds for exemptions. Road projects typically do not meet the exemptions under SEPA because of the amount of excavation required (more than 500 cubic yards exceeds the threshold) or development in an environmentally-sensitive area such as wetlands is proposed. A SEPA checklist should be able to demonstrate that mitigation measures could reduce impacts below 'significant' levels. In that case, the County (if lead agency) would issue a Determination of Non-significance (mitigated), meaning the project would not require an environmental impact statement.

Title 19, Chapter 19.15, Critical Areas

Cowlitz County designates critical areas and administers development regulations consistent with the GMA to assure the conservation of those areas in accordance with the best available science. Critical areas include: wetlands, aquifer recharge areas, geologically hazardous areas, fish and wildlife habitat, and frequently flooded areas. A critical area determination must be requested, and, if required, a critical area permit obtained. The overarching approval criteria is that the project, with mitigation, protects the critical area functions and values consistent with the best available science and results in no net loss of critical area functions and values.

Title 19, Chapter 19.20, Shoreline Management

This chapter implements the state Shoreline Management Act for Cowlitz County and the City of Kelso. A separate document, the Shorelines Management Master Program for Cowlitz County, Washington (1977), maps the shoreline areas and establishes the shoreline development regulations.
The Cowlitz River is listed on Plate I of the Cowlitz County Shoreline Map as a Shoreline of Statewide Significance with an Urban Environment District designation through the City of Kelso. Urban Districts allow the most intense uses of the shoreline while still protecting its natural values. The Shoreline Management Act (RCW 90.58.030 (1)(d)) defines "shorelands" as "those lands extending landward for two hundred feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward two hundred feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters." Therefore, the subject site clearly lies within the Cowlitz River shorelands because of the floodplain, wetlands, and other features associated with the river.

The main use Goals applicable to the project are Circulation, Public Access, and Other General Shoreline Uses. The Circulation goal and objectives require that transportation facilities are sited appropriately, have a minimal adverse effect on the natural and scenic environment, and fulfill a need that can only be satisfied by constructing on the shoreline as opposed to on uplands.

The Public Access goal and objectives require proposed uses to assure safe and reasonable access by the public to public property in the shorelines of Cowlitz County. Future roads, when built paralleling shorelines, must, wherever possible, provide multiple point access to the shoreline to ease concentration. The Other General Shoreline Uses section contains a policy for fills and cuts. Significant damage to existing ecological values or natural resources must not occur from cuts or fills nor create a hazard.

The shoreline management program establishes twenty-one sets of shoreline use activities that are characteristic of the shoreline corridor. Policies and regulations for each use activity category are intended to serve as the primary set of criteria for evaluating proposed developments and alterations to the shoreline environment. Use Activity regulations applicable to the project fall under sections for Landfill and Dredging, and Roads and Railroads. In Urban Districts Dredging or landfill operations with urban shorelines are considered as a conditional use (requiring a conditional use permit). The Roads and Railroads Use Activity section contains the following regulations in the Urban District:

- Non-motorized trails shall be permitted within urban shorelines.
- Railroads shall be permitted within urban shorelines.
- Future construction of all roads, highways, freeways, and access roads shall assure compliance with existing county rules and regulations addressing such construction.
- All public roads and railroads shall not impede non-motorized public access to public shorelines.

Applications for a permit required under the Shoreline Management Act can fall into one of three permit categories and procedures. The Director determines whether the proposal will be processed as a substantial development permit, a conditional use, or a variance permit.

Substantial Development Permits are applicable to allowed uses, unless otherwise indicated in the master program. Conditional uses are those uses which either do not need a shoreline location or are considered unsuitable for siting within a particular shoreline environment. Variance permits are to grant relief to a property owner there are practical difficulties or unnecessary hardship in the way of carrying out the strict letter of the master program.

Review of Consistency of the Options with Comprehensive Plan Policies

City of Kelso

This section primarily applies to private subdivision development. Because the proposed road improvements are a public project, all of the alternatives would comply with the key aspects of Goals B and C, which are to ensure that roads meet the City's standards. Policy 6, Limiting driveway accesses on collectors: implementing the Hawthorne options would be less consistent than Hazel Street options because Hazel Street is already improved; Hawthorne improvements would create more undesirable movements from driveways onto the collector/arterial	**1. LAND DEVELOPMENT AND SUBDIVISION** Goal B: To require the provision of public utilities as an integral part of the land subdivision and development process. Goal C: To insure that subdivision and associated public utilities particularly for residential subdivisions, are designed and constructed to meet existing as well as forecasted future needs. Policies: 2. Subdivision streets, alleys, water lines, sewer lines, and other services and utilities should be designed and sized according to the Comprehensive Plan, the city water and sewer plans, and site master plan projections for future usage and development capacity. 6. Intersections of local and collector streets with minor and major arterials should be minimized. 7. Direct driveway access to minor arterials and collector streets should be minimized. Driveway access onto major arterials should not be permitted.
All options would provide enhanced access to undeveloped land. Option 1 would have the least impact because it would likely have least amount of new impervious surface. Impacts increase from Options 2A/2B to maximum impacts from Options 3 and 4.	Goal G: To insure that development activity causes minimal impact to the environment as well as adjacent and nearby public and private properties and facilities. Objective To investigate techniques and methods whereby upland areas join with lowland areas within identifiable drainage basins to form and financially support a full range of surface drainage management. Policies: 1. Upland developments that would significantly increase runoff to lowland areas should be required to institute measures to collect, control, and properly phase the discharge of drainage from the development site. 2. Lowland developments in areas of seasonally high water tables, flood prone areas, or in areas where standing or ponding of drainage or flood waters is an annual problem will be required to participate in a drainage or diking district which handles such drainage problems.

All of the options could induce future growth in the subject area, if urban sanitary services can be provided. Comprehensive Plan and zoning consistency would need to be reconciled through plan or code amendments to allow this to happen since currently the Plan calls for commercial development.	**RESIDENTIAL LAND USE** Goal B: To meet the future housing needs of Kelso residents through the provision of a variety of dwelling types, densities, and costs in all areas of the city. Policies: 4. The continuing shift from single family to multi-family dwellings should be encouraged in the central business district area, West Kelso and South Kelso. 5. Medium density development i.e. single family, duplex, or triplex units, should continue in South Kelso (south of Mill Street) and in North Kelso, both within and beyond present city limits. 7. Mobile home parks and subdivisions should be encouraged to locate in primarily two areas of Kelso: (b) South Kelso and its growth area, primarily at the east end of Walnut Street, between Hawthorne and Willow Streets, and in the South River Road vicinity.
Providing a safe crossing under any of the options would be consistent with Policy 3	**CHAPTER 3: Commercial Development and Land Use** Goal E: To utilize existing natural resources as an element of downtown development and improvement Policies: 3. To tie the Cowlitz River shoreline in with downtown retail activity, the city and downtown businesses should develop a safe means of crossing the railroad tracks
All options would provide enhanced access to industrially-zoned properties and therefore are consistent. Options 3 and 4 would have more industrial displacement impacts and therefore be less consistent with Goal B	**CHAPTER 4: Industrial Development and Land Use** Goal B: To provide for stable and diversified economic growth in the industrial and manufacturing sector. Policies: 6. Future industrial development (including any and all infrastructure and utilities) occurring along the shorelines of the Coweeman, Cowlitz and Columbia Rivers, should be located as to not interfere with traditional public access to the shorelines of these rivers.
Hawthorne Options 3 and 4 would have the potential to disrupt residential neighborhoods east and west of the tracks. Options 2A and 2B could bring industrial traffic into the redeveloped local streets. could be less consistent with policies 5, 8. Option 1 would be most consistent by generally having the least impacts on the residential neighborhood.	Goal E: To buffer residential areas from industrial use generated noise, odors, lights and traffic. Policies: 5. Industrial sites adjacent to or abutting residentially zoned lands should provide building setbacks of 25 feet or greater on the side adjacent to or abutting the residential zones. 8. Access to or from industrial sites should not be permitted via streets which go through residentially zoned areas.

Underpass Options 1 and 3 may be less consistent because of the need to excavate in the railroad berm that acts as a levee; greater risk for problems due to potential flooding	Goal G: To ensure that all dikes shall be suitably protected from erosion or damage that may inadvertently occur during new industrial site construction or maintenance of exiting industrial buildings and roadways.
All options would be consistent with enhancing to the shoreline areas within the subject area	Goal H: To assure that safe and reasonable public access areas are provided and maintained to the Cowlitz, Columbia and Coweeman river shorelands for the citizens of Kelso and Cowlitz County.
Options 1, 2A and 2B would be most consistent since they would impact less wetland areas than Options 3 and 4.	Goal F: To identify and protect those areas along the Cowlitz, Coweeman and Columbia rivers that serve as wildlife habitat, wetlands and floodplain areas form indiscriminate industrial, residential and commercial development. Policies: 3. Where proposed industrial uses border identified wildlife habitat, wetlands, floodplain areas and flood control structures (dikes), the applicant should demonstrate what measures will be taken to minimize negative impacts on such adjacent areas and structures. 4. Industrial uses on floating structures should be located so as not to rest on the river bottom at high water; such structures should also be protected against currents and waves.
All options would be consistent with Goal A, and associated policies Note: the development of the Elk's Golf Course as a commercial development is no longer part of the City's vision for this area.	**9. TRANSPORTATION/CIRCULATION** Goal A: To provide for a safe, convenient, and economical transportation and circulation system. 1. Establish new transportation links between the Kelso Industrial Park, South Kelso, downtown Kelso, the proposed regional mall (Elk's Golf Course), the commercial development east of the freeway, Tam O'Shanter Park, the high schools, and Interstate 5 to help relieve present and future worsening of Allen Street traffic and over use of downtown streets. (e) Bike and pedestrian connections and improvements between the proposed mall, Schroeder Field development, and downtown Kelso. This could be a project jointly sponsored by the city, mall developer, and downtown merchants. 2. The city, the State Department of Transportation, and private commercial interests should continue to coordinate and pursue means of easing traffic flows between East Kelso commercial, residential, and school areas and the proposed mall facility, South Kelso, Schroeder Field development, and downtown West Kelso.

Hawthorne options would not be consistent with Objective 1. Closing both Yew Street and Mill Street crossings would be less consistent than closing only one crossing	Goal B: To provide diverse, well-planned and designated facilities for the movement of vehicular, bicycle, and pedestrian traffic. OBJECTIVES: 1. To improve access to the South River Road area while keeping traffic out of the Hawthorne Street residential area and to promote planning for possible future construction of a third Cowlitz River bridge crossing. Possible Solutions: (a) Construct a vehicular and pedestrian underpass at Hazel Street or, at a minimum, a substantially improved grade crossing at that location. (b) Substantially improve the Mill Street crossing or, at the least, provide some grade crossing improvements and close it to through traffic. If ever closed entirely, closure should occur only when an underpass is constructed in the area. (c) Substantially improve the Yew Street crossing and discourage its use once and underpass is constructed in the area.
All options would be consistent with Goal C to the extent that safer crossing of railroad tracks is the result	Goal C: To repair and upgrade to city standards all existing streets and roads in the City of Kelso. POLICIES: 2. The railroad crossings at Yew, Mill, Donation, and Redpath Streets should be improved and made safer.
All options, by improving safety and pedestrian and bike access to the golf course, would be consistent with Goal D	10. Parks, Recreation and Open Space Goal D: To develop open space linkages such as trails and bike paths located on a variety of rights-of-way which serve to tie together and enhance the value of separate open space and park elements and other uses
All options, by improving safety and pedestrian and bike access to the Cowlitz River shoreline area, would be consistent with Goal E	Goal E: To promote plans, programs and developments which increase public access to the city and region's lakes, rivers, and streams

Cowlitz County Comprehensive Plan

All options, by improving vehicle, pedestrian and bike mobility and safety would be consistent with Goal F	Growth and Development Goals F. Encourage a balanced transportation system which provides efficient mobility of people, goods, and services within the county.
All options would provide enhanced access to industrially-zoned properties and therefore are consistent. Options 2 and 2A may have highest industrial displacement impacts and therefore be less consistent with "A".	Industrial and Ag-Industrial Land Use Goals and Policies A. Provide for adequate land to accommodate a moderate level of economic growth in Cowlitz County.
Hawthorne options would be more consistent with this goal because there would be no impact to the county's agricultural land base, although there does not appear to be an agricultural use within the AG-zoned area.	Agricultural Land Use Goals and Policies A. Maintain a productive agricultural land base. Policies: 1. Protect prime agricultural soils for crop and livestock production and to discourage land use activities which conflict with agricultural production.
Hawthorne options 3 and 4 would have the potential to disrupt residential neighborhoods east and west of the tracks with industrial traffic. Options 2 and 2A would bring industrial traffic to Virginia St. Options 1 and 1A, 2 and 2A, would be most consistent by avoiding impacts to the residential neighborhood west of the tracks. Options 1 and 1A would impact existing uses the least.	Transportation Element A. The development of transportation facilities must be coordinated closely with planned land uses, particularly those serving intensive economic activities.
All options would be consistent with a collector width of 60 to 80 feet, and with the description of the functions of urban collectors	Arterial and Street Plan Street Classification System: 4. Major Collector – (60 to 80 feet right-of-way) a. Rural – provides for inter-regional and inter-county traffic 82 b. Urban – provides trips within developed areas and between minor arterials and minor collectors, and local access streets. Serves approximately 1,500 lots or units in urbanizing areas. It provides for traffic movement within developed areas and between major arterial streets and collector and local access streets. It serves traffic between neighborhoods and may provide direct access to abutting property when conditions warrant.

DAVID EVANS
AND ASSOCIATES INC.

MEMORANDUM

DATE: January 18, 2012

TO: Neal Christensen

FIRM: David Evans ans Associates

FROM: Mara Krinke

SUBJECT: **Environmental Justice Screening Memorandum**

PROJECT: KESO0000-0002 – SOUTH KELSO RAILROAD STUDY

COPIES: file

Introduction and Approach

David Evans and Associates, Inc. (DEA) has performed a preliminary investigation of the South Kelso Railroad Crossing proposed road alignment to identify potential concerns related to environmental justice and project impacts. In developing this memorandum, no field research was conducted; the memorandum relies on census data for the State of Washington, Cowlitz County, and the project area.

Overview of Environmental Justice

Executive Order 12898 on Environmental Justice directs federally funded programs, policies, and activities to examine whether they would have disproportionately high and adverse human health and environmental effects on minority or low-income populations.

The fundamental concepts of Executive Order 12898 are to:

- Identify protected populations that could be affected by a project, to help avoid, minimize, or mitigate disproportionately high and adverse effects on those populations.
- Ensure participation by the communities in the transportation decision-making process.
- Prevent denial or delay of the receipt of benefits by the protected populations.

"Disproportionately high and adverse effects" means an adverse effect that is predominately borne by a minority population and/or a low-income population; or will be suffered by one of those populations and the impact is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority or non-low-income populations.

The term "high and adverse effects" includes not just displacement of residents and businesses but also other types of adverse impacts such as those resulting from increased air and water pollution, noise levels, visual disruption of a neighborhood, and environmental damage from hazardous materials.

Mitigation and offsetting benefits to affected populations can be taken into account when determining whether a project will have disproportionately high and adverse effects on minority and low-income populations.

Demographics of Project Area and Comparison Groups

Table 1 presents demographic data from the US Census for the project area, the city of Kelso, Cowlitz County, and the state of Washington. Project area information is based on Census Tract 11, which includes roughly half the population of the city.

Based on the census data presented in Table 1, the project area has slightly higher percentage of Hispanic population, minority population, and population living below the poverty level than the City of Kelso or Cowlitz County as a whole. Compared to the state of Washington, only the percentage of persons living below the poverty level exceeds state levels. Based on the comparison with county demographics, the project area may include populations that could trigger environmental justice concerns (minority, Hispanic). However, compared to the City of Kelso population, the demographics are fairly similar.

Table 1: 2010 US Census Statistics

	Project Area[1]	City of Kelso	Cowlitz County	Washington
Population	5,800	11,925	102,410	6,724,540
Percent minority[2]	19.0%	14.8%	11.1%	22.7%%
Percent Hispanic[3]	12.6%	11.3%	7.8%	11.2%
Percent Below Poverty Level	23.1%	21.0%	16.0%	12.3%

Sources: U.S. Census Bureau, 2010 Census; NY Times Mapping America: Every City, Every Block" Source data- 2010 Census; U.S. Census Bureau, 2010 American Community Survey, "Poverty Status in Past 12 Months- 2010 American Community Survey One-Year Estimates", 2010 U.S. Census 2006-2010 American Community Survey 5-Year Estimates, "Poverty Status in the Past 12 Months"

[1] Project area includes Census Tracts 11 – Cowlitz County.

[2] Minority persons are those reporting race other than white.

[3] Hispanic persons can be of any race.

The project area does not include any known affordable housing projects. The Kelso Housing Authority owns and operates 100 public housing rental units and oversees two apartment complexes for individuals with disabilities, none of which are in the project area.

Displacements and Other Impacts Associated with the Project

Options 1 and 2 will displace one residence and between two and three businesses. It is not known if the residential displacement affects a low-income, minority, or Hispanic person or household. Options 3 and 4 are expected to replace four or more residences and one to two businesses. Residential displacements would be mitigated through property purchase and provision of relocation assistance. Business displacements would be mitigated with relocation assistance.

The project area appears to have a higher proportion of persons living below the poverty level than the state does as a whole. However, the census data that generates this conclusion is drawn from a larger area than the

immediate study area, one that includes downtown Kelso. Further investigation would help define if the project area is in fact an area with a low-income population.

The impacts associated with Alternatives 3 and 4 are higher for individuals than the impacts associated with Alternatives 1 or 2. However, even if the households that could be displaced are found to be minority or low-income, it does not appear that the impacts to a population would be disproportional and adverse, due to the mitigation of impacts that would occur through the right-of-way acquisition process.

Summary of Potential Environmental Justice Concerns

Census data and anticipated project impacts indicate that the project area may include low-income populations. However, due to implementation of mitigation measures associated with residential displacements, displacement impacts are not likely to be high and adverse, thus minimizing anticipated environmental justice concerns related to the project. The displacement impacts associated with Alternatives 1 and 2 appear to be lower than those associated with Alternatives 3 and 4. Noise and visual impacts would be lower with Alternatives 1 and 2 as well. From the perspective of the existing residents of the study area, it is likely that Alternatives 1 and 2 are likely to be preferred over Alternatives 3 and 4.

To ensure public participation and equitable distribution of mitigation and project benefits, public outreach efforts should be conducted prior to selection of the preferred alternative to assess and respond to community concerns about the project.

Attachments/Enclosures: Vicinity Map, Aerial Photo

Initials: JDM/dgaf

File Name: P:\K\KESO00000002\0600INFO\0670Reports\0671 Environmental Memos\0671-B Sensitive Areas Memo\Draft\2012-01-11_Sensitive Areas Memo.docx

Appendix F

Design Criteria Worksheets

Kelso Railroad Crossing
Design Criteria Worksheet

Section: Hazel Street Crossing

PROJECT DATA	*DATA*	*REFERENCE*
Functional Classification:	Collector	City of Kelso
County Classification System:	Minor Arterial	WSDOT
NHS:	☐ Yes ■ No	
Freight Route:	☐ Yes ☐ No	
Truck Route:	☐ Yes ☐ No	
Scenic Byway:	☐ Yes ■ No	
Expressway:	☐ Yes ■ No	
Bypass:	☐ Yes ■ No	
Urban Classification:	■ UBA ☐ CC ☐ STA	
Mobility Route:	Hazel Street connects to 13th Ave and Pacific Ave which run north-south and connect to major routes	
Current ADT (2011):	TBD	
Design ADT (2035):	TBD	
% Trucks (FHWA Vehicle Class 4-13):	TBD	
SIP Category (Year):	N/A	
Top 10% SPIS Site (Year, MP):	N/A	
Terrain:	■ Level ☐ Rolling ☐ Mountainous	AASHTO 2004 (pg. 231)
Posted Speed:	25 mph (Hazel Street) 35 mph (Pacific Ave)	
Right of Way Width:	70' (Collector) 80' (Arterial)	Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Corridor Plan Checked:	N/A	Contact: Phone #: Date:
Inside UGB:	☐ Yes ☐ No	
Design Standard:	AASHTO City of Kelso BNSF and UP Joint Manual	AASHTO 2004 Engineering Design Manual 2008 Guidelines for Railroad Grade Separation 2007

Kelso Railroad Crossing
Design Criteria Worksheet

This checklist is to confirm interpretation of standards. Your project may require that additional/different/or fewer Design Elements be addressed.

DESIGN ELEMENT	***STANDARD*** ***Design***	***Plans***	***REFERENCE & COMMENTS***
Design Speed (Path)	25 mph (Collector) 35 mph (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Lane Width	12’ (Collector) 11’ (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Shoulder Width	8’ (Collector) 5’ (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Median Width	N/A (Collector) 12’ (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Bridge Width	44		AASHTO 2004 (pg. 426), Exhibit 6-6
Bike Lane/Multi-Use Path	N/A (Collector) 5’ (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Sidewalk Width/Buffer Strip	12’ (Collector) 11’ (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
Pavement Cross Slope	1.5% - 3%		AASHTO 2004 (pg. 431)
Barrier/Guardrail	Yes		
Parking	8’ (Collector) N/A (Arterial)		Engineering Design Manual (pg. 3-12) Engineering Design Manual (pg. 3-11)
ADA/Sidewalk Ramps	Yes		
Horizontal Clearance	1.5' beyond face of curb		AASHTO 2004 (pg. 437)
Vertical Clearance	17.5’ to Structure 23’-4” to TOR		Guidelines for RR Separation- Under Guidelines for RR Separation- Over
Side Slopes and Clear Zone			
Street Trees/Landscaping	Yes		
Ditch x-section	N/A		

Kelso Railroad Crossing
Design Criteria Worksheet

DESIGN ELEMENT	*STANDARD* *Design*	*Plans*	*REFERENCE & COMMENTS*
Horizontal Alignment			
Superelevation Rate	4% Max		Engineering Design Manual (pg. 3-18)
Superelevation Runoff	69’ (Collector) 77’ (Arterial)		AASHTO 2004 (pg. 181)
Minimum Spiral Length	74’ (Collector) 103’ (Arterial)		AASHTO 2004 (pg. 189)
Minimum Radius	198’ (Collector) 510’ (Arterial)		AASHTO 2004 (pg. 151)
Vertical Alignment			
Grade	10% Max (Collector) 7% Max (Arterial)		Engineering Design Manual (pg. 3-18)
K Crest	12 (Collector) 29 (Arterial)		AASHTO 2004 pg. 272
K Sag	26 (Collector) 49 (Arterial)		AASHTO 2004 pg. 277
Sight Distance			-Correct for grade as appropriate
Stopping Sight Distance	155’ (Collector) 250’ (Arterial)		AASHTO 2004 pg. 272
Decision Sight Distance	490’ (Collector) 590’ (Arterial)		AASHTO 2004 pg. 116
Passing Sight Distance	N/A		
Intersection Sight Distance	280’ (Collector) 390’ (Arterial)		AASHTO 2004 pg. 661
Intersection			
Skew Angle	90 °		
Turn Lanes	0		
Drainage			
Pipe Flow Velocity			
Min. Pipe Slope	0.50%		
Pipe Diameter	12"		
Min. Pipe Cover	1´ – 0"		
Culverts	N/A		
Sloped Ends	N/A		

Appendix G

Letters on at Grade Closures from Kelso and Cowlitz County

CITY OF KELSO
COMMUNITY DEVELOPMENT DEPARTMENT
P O Box 819
203 S. Pacific Ave., Suite 208 Kelso WA 98626
(360) 423-9922, fax (360) 423-6591

April 12, 2012

Michael Kardas, P.E.
Senior Civil Engineer
203 S. Pacific Ave., Suite 205
P.O. Box 819
Kelso, WA 98626

RE: Mill Street Crossing

Dear Mike:

The goals, policies and objectives listed in the transportation/circulation element of the Kelso Comprehensive Plan state; **Goal B:** To provide diverse, well-planned and designed facilities for the movement of vehicular, bicycle, and pedestrian traffic. **Objectives:** To improve access to the South River Road area while keeping traffic out of the Hawthorne Street residential area and to promote planning for possible future construction of a third Cowlitz River bridge crossing. It also identifies "possible solutions" as *a) construct a vehicular and pedestrian underpass at Hazel Street or, at a minimum, a substantially improved grade crossing at that location. b) substantially improve the Mill Street crossing or, at the least, provide some grade crossing improvements and close it to through traffic. If ever closed entirely, closure should occur only when an underpass is constructed in the area. c) substantially improve the Yew Street crossing and discourage its use once an underpass in constructed in the area.*

Based on the above information as well as information provided by David Evans and Associates, Community Development would support the Mill Street crossing to remain open, with the stipulation it is not for through traffic.

If you have any questions or need additional information, please feel free to give me a call at (360) 577-3320.

Sincerely,

Nancy Malone

Nancy Malone
Community Development Manager

KELSO POLICE DEPARTMENT

Andrew O. Hamilton
Chief of Police

Darr Kirk
Captain

April 11, 2012

Mike Kardas
Senior Engineer, City of Kelso
PO Box 819
Kelso, WA 98626

Re: Railroad Crossing

Dear Mike:

Per our discussion regarding the proposed above grade crossing, I consulted my staff and we came to the following conclusion:

> We would agree with Cowlitz County Fire & Rescue, District 2, that the Mill Street crossing remains open for a secondary egress route. Looking at the past history of this area, we can remember a number of times one crossing was blocked restricting access to the area. This has effected law enforcement, fire and medical calls. We have also seen this area flood and a secondary access point for public safety is needed.

If you have any questions or concerns regarding these comments, please call me at 360-423-1270, or my direct extension of #3400.

Sincerely,

Andrew O. Hamilton,
Chief of Police

AH/smt

Cc: David Sypher, Public Works Director
Randy Johnson, Public Works Superintendent
Dave Lafave, Cowlitz 2 Fire & Rescue, Chief

Cowlitz 2 FIRE & RESCUE

March 23, 2012

RECEIVED
ENGINEERING
MAR 26 2012
CITY OF KELSO

Michael Kardas, PE
Senior civil Engineer
City of Kelso Department of Public Works
203 South Pacific
Kelso, WA 98626

Dear Michael,
While we, at the Fire District, highly recommend moving forward with plans for a new grade separated railroad crossing to the South River Road area of Kelso, I also recommend keeping an at grade crossing available at Mill Street for emergency access. The area served by the Mill Street Crossing is prone to flooding, which may prevent any access into the area from the proposed overcrossing by emergency response vehicles. Leaving the at grade crossing available also maintains an important second egress point in the event that area had to be evacuated for any reason. I realize that the goal is to eliminate at-grade rail crossings for general day-to-day use however, if this crossing is allowed to remain for emergency use only, it may prove to be a lifesaving alternative for residents in that area.

Sincerely,

Alan Headley
Assistant Chief

701 Vine Street • Kelso, WA 98626-2621 • (360) 578-5218 • Fax (360) 578-5220 • www.c2fr.org

Appendix H

Public Involvement Documentation

Stakeholder Meeting Notes

Open House Notes

Meeting Minutes

Technical Stakeholders Group (TSG) Meeting #1 **September 25, 2011**
South Kelso Railroad Study 3:00 pm to 5:00 pm

Attendees:

Mike Kardas, Project Manager City of Kelso
Amy Asher, CWOG
Brad Bastin, Cowlitz County
Kirk Fredrickson, WSDOT
Ken Hash, WSDOT
Neal Christensen, DEA, Project Manager
Adrian Esteban, DEA, Engineering Task Lead
Tom Walsh, DEA, Public Involvement

A. Introductions

- A binder was handed out to the participants that contained the agenda, project fact sheet, and options.
- Introductions were made around the table.

B. Project Overview

- Mike Kardas started the meeting with a discussion on the overall project goals and the background of funding for this project. Main task and items of this project are to review work that has been completed and recommend a safe, viable option for crossing the BNSF mainline in South Kelso in the vicinity of Hazel Street. He mentioned that as part of the study, the City would consider eliminating one of the current at-grade crossings (Mill Street or Yew Street), preferably Yew Street. This study will provide a recommended crossing option that will identify issues and concerns and will be a significant step in advancing the overall goal of a new and improved rail crossing. The intent is to progress as far as possible on the investigation and design with the available funding.

- Kirk Fredrickson discussed the Kelso-Martin Bluff project and was pleased that the rail crossing study is out ahead of that rail project. Kirk discussed the following points:

    - Train traffic: UP, BN, Amtrak, Cascades (4/day going to 6/day) which is about a total of 40-60 trains/day.
    - 2009 grant applications totaled $1 billion for rail corridor improvements including additional passenger trains, high-speed rail, capital improvements, and improved on-time performance.
    - Federal government reduced allotment to $590 million; WSDOT dropped some proposed improvements due to budget allotments which was reduced from the original request. Part of those items dropped were the improvements at the Hazel Street crossing.
    - Kelso-Longview Jct segment is included in the the 2009 Grant application.
    - This area is part of the $126 million mainline project (from Kelso station to Longview Jct) and needs to be completed by July of 2017.

- The existing storage track will become 3rd mainline track.

C. Project Fact Sheet

- Tom Walsh discussed the project fact sheet which is a brief summary of history and goals of the project. In addition, he discussed the roles of the consultant and the stakeholder groups. A brief overview is listed below:

  - *Consultant Task:* The goal is provide a preliminary design that is usable for future phases, intended that the study provide the basis and justification for securing the funding needed to complete the project.
  - *Stakeholder Group Roles*: There will be two Stakeholder groups. The Technical Stakeholder Group (TSG) and the Community Stakeholder Group (CSG). Committee Schedule: anticipate up to three TSG meetings and 2 CSG meetings.
  - Everyone at this meeting agreed to also be part of CSG.

D. Project Alternatives Review

Neal provided a brief discussion on the history of studies completed to date and provided an overview of the current options. The study is just beginning and we would appreciate feedback and discussion on issues form the TSG. Options discussed included:

- Hazel Street alignment
  - o Provides overall good connectivity to the surrounding area, through 13th Avenue to Talley Way and I-5.
  - o Hazel Street is currently classified as minor arterial and has adequate existing width to accommodate this project.
  - o Alignment minimizes impacts to residential buildings.
  - o Minimal skew allows for shorter structure and improves general constructability.
  - o Midpoint access to area west of tracks, with the golf course to the south and residences to the north.
  - o Divides area into residential and commercial areas.

- Hazel Street alignment <u>over</u> Rail
  - o Minimal rail operations impact.
  - o Elevated structure will need to be approximately 40- 45’ above existing ground.
  - o Connection to South Pacific
    1. Raise South Pacific to match new Hazel Street elevation.
    2. Provide alternative connection to new crossing via Virginia Street.

- Hazel Street alignment <u>under</u> Rail
  - o Will require shoofly alignment for rail operations during construction.
  - o Road will need to be approximately 20-25’ below the top of the rail, which is 10-15’ below existing ground.
  - o High ground water in the area and drainage way will be an issue.
  - o Assume a pump station will be needed.

- Hawthorne Street alignment
    - o Slightly closer to existing crossings.
    - o Need to extend Hawthorne Street across slough to provide connection to 13th Avenue.
    - o Improvement on existing Hawthorne Street would be required.
    - o Could cause potential significant residential property and housing impacts on the west side of the tracks.

- Typical Section, Road Classification, & Design Speed Discussion

  There was a general discussion on what is the appropriate road classification for this new crossing. This impacts among other items: typical section, design and design speed.
    - o Minor arterial – 35 mph design speed three-lane section, with bike lanes and 80' ROW width.
    - o Collector – 25 mph design speed, two-lane section, with parking and 70' ROW width.
    - o This project will review sections and come up with a recommendation that will likely modify standard sections to be consistent with ultimate goals of the new roadway. The recommendation likely will include 2 travel lanes, bike lanes, and sidewalk and expand for turn lanes only at intersections, as needed.

E. General Discussion and questions

General discussion points listed below:

- **Emergency response:** Need to evaluate response time for emergency responders to the furthest point. Emergency access could be a factor for maintaining a 2nd crossing and for determining the best location of the proposed crossing.
- **Airport:** FAA issue for the height of a new structure will require coordination. Mike Kardas said he had spoken with the airport and the FAA would require a 44' maximum structure height which would likely require shorter luminaires spaced closer together.
- **Bike and Pedestrian Connectivity:** Bike lanes and sidewalks will be required throughout and parking needs are to be reviewed on a case-by-case basis.
- **At-Grade Crossings:** WSDOT would like to review issues with closing both at-grade crossings (Mill and Yew). An undercrossing eliminating both at-grade crossings could have implications for oversized loads west of the tracks.
- **Utilities:** Study will include a dry line for sewer collection; verify if water main is needed for the future; reserve a proper amount of space in design for utilities.
- **Stakeholders:** It was recommended that an airport representative be included in the community stakeholder group or at least be included in communication of plans. Similarly, a diking district representative should be included in the conversation as well.
- **Intergovernmental Agreements:** Cowlitz County and the City of Kelso need an agreement for road design (may split into minor arterial on the east side of South Pacific Avenue, collector on the west side).
- **Other:** Include and address long term maintenance costs (i.e., operating and maintaining pump station) factor into total probable cost of options.

F. Schedule

- It was recommended that we add a County Council presentation to our schedule.
- Overall schedule was discussed on the Project Fact Sheet. Neal will email specific dates of the next Stakeholders meetings and the open house to the group.

Decisions from meeting

- The Hazel Street corridor is an appropriate corridor for further investigation.
- Include Hawthorne Street alternative, only as an option considered.
- A modified standard typical section will be investigated and consideration will be given to bicycle and pedestrian connectivity.
- Review issues using the following roadway designations: Minor Arterial east of track and Collector west of tracks.

Action items from meeting

- Mike will provide the airport study to DEA.
- Kirk will provide the name of the new person to replace him on the TSG.
- Neal will provide dates of the next stakeholders meeting and post the information online.

Meeting adjourned.

Meeting Minutes

Stakeholder Meeting #2 **December 13, 2011**
South Kelso Railroad Study 3:00 pm to 5:00 pm

Attendees:

Mike Kardas, Nancy Malone - City of Kelso
Rosemary Siipola - CWCOG
Brad Bastin, Cowlitz County
Ken Hash, David Smelser – WSDOT
Chris Smith- 3 Rivers Golf Course
Neal Christensen, Adrian Esteban and Tom Walsh- DEA

A. Introductions

Brief introductions were made around the table and a project binder was handed out to the Chris Smith from the 3 rivers golf course. Updated graphics and option information was handed out to all participants.

B. Stakeholder Meeting Review

Tom Walsh summarized the goal of project and previous work to date. He reviewed the meeting minutes from the Stakeholder meeting #1 and revisited some decisions made to date.

David Smelser, Cascades HSR Project Coordination Manager from WSDOT discussed updates to the Kelso to Martins bluff project

- Federal Railroad Administration (FRA) approved moving the Kelso to Martins Bluff to preliminary design 2 weeks ago.
- FRA needs to meet service requirements through the corridor with $200m budgeted but not tied to specific elements in the corridor.
- BNSF construction to occur 2015-16 and needs to be fully operations by 2017
- BNSF will have preliminary layout for high speed rail in 3-4 months.
- BNSF is looking at making distance between rail centerlines 25’ (currently at 20’).

C. Purpose/Role of CSG

Tom discussed the original expectations of the Community Stakeholders Group (CSG) and the Technical Stakeholders Group (TSG) and he suggested the two groups combine into one group. Everyone agreed and moving forward the two groups will be combined into one stakeholder group.

D. Project Alternatives Review

Neal Christensen briefly discussed the handouts and he discussed the modified typical sections. The designs have been advanced to show preliminary retaining wall locations, review of potential drainage and water quality issues, ground water information and airport flight path information.

Option 1 – Undercrossing at Hazel:

- This option would lower the grade of Hazel Street and S Pacific to create an underpass below the existing Railroad Berm.
- The underpass structure would then be owned by BNSF (also they will primarily select bridge type, geometrics, etc). This would likely require additional maintenance dollars from the city.
- There would be an additional potential building impact near Milwaukee Place.
- Shoofly would cause temporary (possibly some permanent) impacts to the golf course.
- The shoofly would move the trains closer to the houses on the west side of the BNSF tracks possibly causing additional impacts from noise and vibration.
- Groundwater estimated approximately 10 feet down. Underpass would place new road surface approximately 12 feet below existing grade. Would need to develop drainage system that separates stormwater from groundwater. Neal discussed possible structural solution that would place underpass roadway in a structure to "seal" it off from groundwater.
- A single span and double span bridge structure were discussed. The single span structure provides the best intersection geometry, while the double span structure will reduce the depth of the structure and thus reduce the amount of cut for the underpass. The group discussed the benefits and felt the single span benefits outweigh the minimal benefit from the double span.
- Possible to introduce a maximum 2% profile grade adjustment to the tracks if it helps to reduce amount of cut for underpass.
- Need to pump stormwater from underpass requiring long term maintenance in addition to initial cost.
- The underpass has the least visual impact.

Option 2 – Overcrossing at Hazel (with Douglas or Virginia connection)

- This option raises Hazel Street over S Pacific and the Railroad tracks.
- There would be visual concern with an overpass from residents because of height compared to surrounding structures. The new overcrossing would be approximately 44 feet above the existing road grade on S. Pacific.
- Because of the grade change approaching the east side of the overcrossing, two additional driveways to businesses on the south side of Hazel would need to be closed off. Although there may a re-configuration possible that saves the accesses, assume for evaluation purposes that these would be complete acquisitions in the budget.
- Due to additional acquisitions it was suggested that alignment shift south to improve alignment.
- Discussed two options for providing circulation from S. Pacific onto the overcrossing – via new connection from Virginia or from Douglas. Both would require construction of a new north/south street connection. Douglas appears preferable. Likely less property impacts and also less impact to neighborhood circulation. Douglas would require re-configuration at its intersection with S. Pacific.
- The bridge structure option was discussed and the columns provide adequate clearance from the future and existing railroad tracks, provide room for the railroad access road and adequate space for S. Pacific Avenue.
- City would own structure (as opposed to BNSF).
- Visual impact will be greater with this option, however architecture treatment and other options such as "terracing" of the retaining walls could provide visual mitigations that would be effective for this option.

Option 2B - Overcrossing at Hazel (raise S. Pacific Ave)

- This option examines the impact of raising the grade on S. Pacific to shorten the structure.
- The group discussed that because of extensive walls and fill needed, and the impacts on the neighborhood, it was decided not to pursue that option further.

Evaluation Worksheet

Neal presented an evaluation worksheet that provides an overview of impacts based on wetlands, ROW, businesses, neighborhood connections, maintenance, construction and aesthetics. Costs have not yet been developed. The worksheet was prepared to generate discussion, but will be refined and modified based on input from the group.

E. General Discussion – All

- Be aware of sight distance issues at the connection to River Road.
- Review direct ("straight") alignment at the west connection to River Road (instead of introducing curvature that confines impacts to a single property).
- Under any scenario, need to consider impacts to neighborhood on east side of S. Pacific from new traffic being directed into the neighborhood to access the crossing.
- Many residents on the west side of the BNSF line have been in the area since the 1950's.
- The Hawthorne Street location was discussed at the TSG meeting (10/25/11). Given the potential building impacts and challenges in aligning the street connection across S. Pacific and the BNSF tracks, it was decided to focus more on the details of the Hazel Street crossing location.

F. Next Steps/Action Items

- Review alternative of "straightening" connection at west to River Road (both options)
- Explore Douglas connection (Option 2)
- Assume driveways closures and potential resulting acquisitions as discussed (Option 2)
- Further develop evaluation criteria based on meeting discussion
- Explore widening of Pacific to the south of Hazel for Douglas connection option

Decisions from meeting

- Option 2B will be included as an option considered, but not advanced.
- Option 1 – 2 span bridge will be included as an option considered, but not advanced.

Meeting adjourned.

Meeting Minutes

Stakeholder Meeting #3 **January 17, 2012**
South Kelso Railroad Study 3:00 pm to 5:00 pm

Attendees:

Mike Kardas, Nancy Malone - City of Kelso
Rosemary Siipola - CWCOG
Brad Bastin, Cowlitz County
Ken Hash– WSDOT
Chris Smith- 3 Rivers Golf Course
Neal Christensen, Adrian Esteban and Tom Walsh- DEA

A. Stakeholder #2 Meeting Review, Results, and Follow-up Actions

- Tom Walsh summarized the previous meeting which included a discussion on how the team would compare the options.
- Tom briefly summarized how we developed the Alternatives Evaluation Definitions – there are many evaluation criteria that were used to compare the alternatives to each other. Based on issues raised by City staff and from the stakeholder meetings, we narrowed the list to (8) key criteria. Tom mentioned that if it is on the list, it has been identified as important enough to gauge how a project alternative addresses that issue. We allotted "weights" to each evaluation criteria with the most important receiving a weight of 10, and so on. For example, safety ranks #1 in importance, and therefore has a weight of 10.
- Tom also briefly mentioned the Evaluation Selection Worksheet which is a matrix of the Alternatives' relative ranking against each evaluation criteria. We compared each alternative to each evaluation criteria and scored them 1 to 5. Some respond to particular criteria similarly, that they received equal scores. From that each alternative received a weighted score. The highest possible total is 245.

B. Design Refinements

- Neal mentioned some of the main refinements that occurred after the last meeting which included straightening out the extension of the Hazel Street alignment on the west side of the tracks for Options 1 and 2 and refining the connection from S Pacific to Hazel Street via the Douglas/3rd Avenue connection for Option 2.
- Neal mentioned the geotechnical findings and that it is believed there is a liquefaction potential in this area to a depth approximately 80'.
- The geotechnical report recommends drawing down the ground water in the area for construction and the drawdown of the groundwater should continue for the life of the project. This may impact the water well supply in the area.

- The geotechnical report also mentioned that ground improvement (stone columns or Vibro compaction) would be necessary in the vicinity of the retaining walls and may be needed for the bridge, depending on which type of structure and foundation support is selected.

C. Evaluation Process

- Tom discussed in the evaluation criteria and ranking in greater detail which is summarized below:

Criteria	*Description*	*Rank (most important =1)*	*Weight (1-10)*
Neighborhood Safety	***Relative safety based on increased traffic to residential areas, and safest environment for non-motorized users. Scoring: Award 5 for best; 1 for worst***	***1***	***10***
Construction Cost	***Which alternative costs the least? Scoring: Award 5 for lowest; 1 for highest***	***2***	***9***
Complete Acquisitions – Business and Residential	***Which alternative requires the least number of complete acquisitions of lots/buildings? Scoring: Award 5 for least impact; 1 for most impact***	***3***	***7***
Constructability	***Which has the lowest risk for potentially significant impacts to safety, cost, or construction feasibility during construction? Award 5 for least and 1 for highest***	***3***	***7***
Environmental Impact	***Which alternative has the least impact from an environmental documentation process? Includes natural resource, visual, and socio/economic issues. Award 5 for lowest; 1 for highest***	***5***	***5***
Redevelopment Opportunity	***Which alternative creates opportunities for future redevelopment of either remnant parcels of land remaining, or on existing land adjacent to the realignment? Scoring: Award 5 for most opportunity; 1 for least***	***6***	***4***
Long Term Maintenance	***Which alternative commits the City to the highest long term maintenance cost? Scoring: Award 5 for best; 1 for worst***	***6***	***4***
Partial Property Acquisitions – Residential and Commercial	***Which alternative has the least overall need to acquire land from existing properties? Scoring: Award 5 for least impact; 1 for most impact***	***8***	***3***

- The Design team scored each Option against the evaluation criteria. The weighted scores are summarized below (maximum score = 245):

Hazel Crossing Location			***Hawthorne Crossing Location***	
Option 1-Under	**Option 2A-Over**	**Option 2B-Over (Raise Pacific)**	**Option 3-Under**	**Option 4-Over**
176	**213**	**117**	**83**	**107**

- It was discussed that the team should look at the option of a separate pedestrian connection under the railroad track near the Yew Street at grade crossing for safety purposes. It does not require the large opening a vehicle connection needs. DEA will review the issues and report on the finding at the next stakeholder meeting.
- The group agreed with the scoring of the options and the end result is in alignment with what people had anticipated.

D. Next Steps

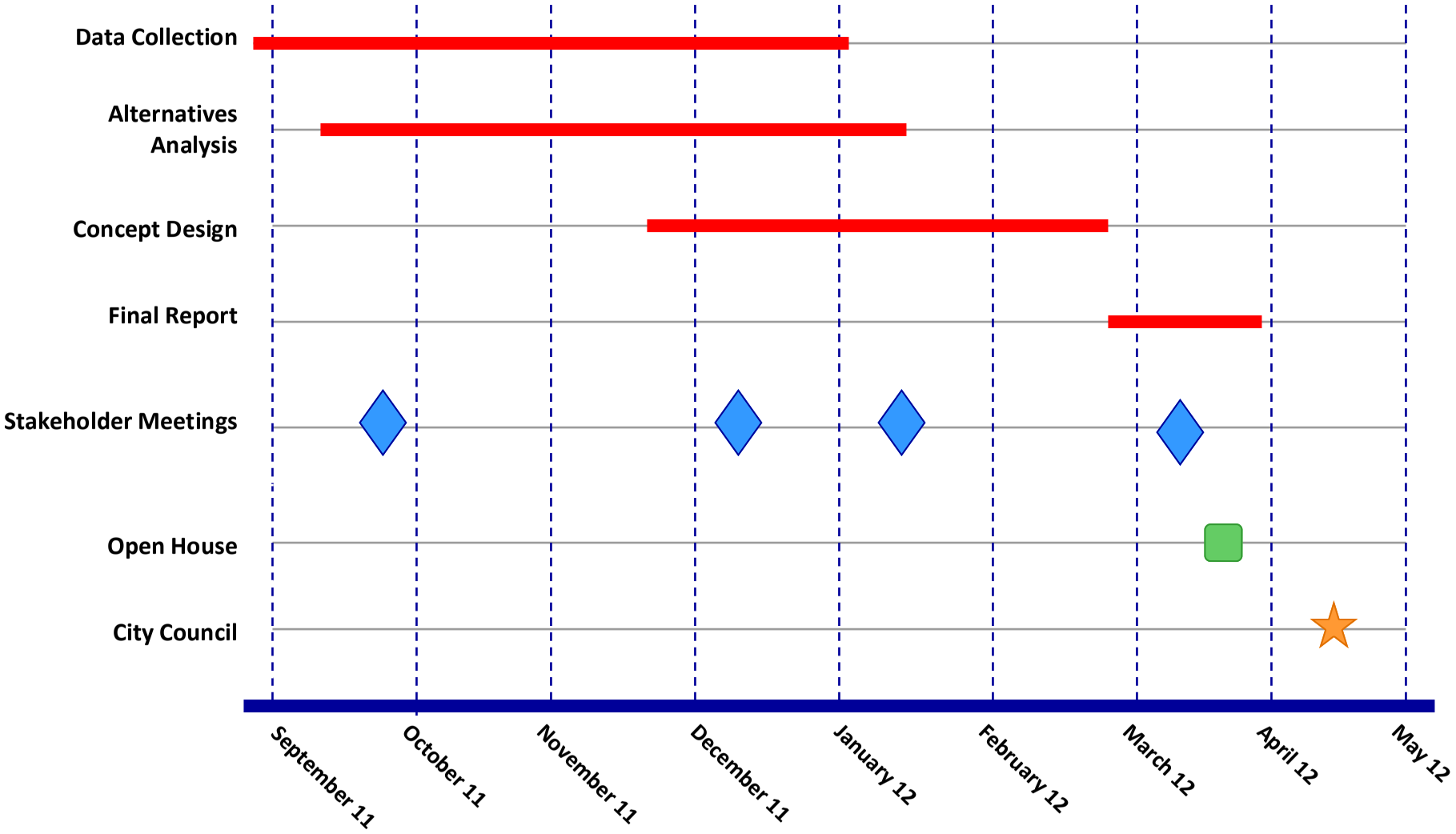
- DEA will refine the costs for Options 1 and 2 and compare these two options directly with each other.
- The meeting schedule has been adjusted for the stakeholder involvement and open house as discussed.
- We anticipate an Open House meeting in March and a stakeholders meeting in advance of the open house.

DAVID EVANS AND ASSOCIATES INC.

City of Kelso
South Kelso Railroad Study

PROJECT SCHEDULE

Updated 2-2-12



DAVID EVANS AND ASSOCIATES INC.

Meeting Minutes

Stakeholder Meeting #4 **March 20, 2012**
South Kelso Railroad Study 3:00 pm

Attendees:
Mike Kardas – City of Kelso
Matt Hermen – CWCOG
Brad Bastin – Cowlitz County
Ken Hash – WSDOT
Chris Smith – Three Rivers Golf Course
Neal Christensen and Tom Walsh – DEA

A. Stakeholder #3 Meeting Review, Results and Follow-up Actions

- Reviewed Stakeholder Meeting #3 results and followed-up. Refined costs focusing on Options 1 and 2; consideration of separate pedestrian-only connection under the tracks near Yew Street.

B. Design and Cost Refinements

- The team met with emergency services representatives (Fire and Police Departments). They were fully in support of the project. The fire district will provide a letter in support of the project. They indicated it was acceptable to close the Yew crossing for their access purposes. They would prefer an emergency access be maintained across Mill because of localized flooding. This may be in the control of BNSF as part of the High Speed Rail project.

- A separate pedestrian undercrossing will be very costly, similar to a vehicular undercrossing. The reason is that there will still likely need to be a railroad shoofly. There is concern about the possibility that settlement may occur under the existing tracks due to unfavorable soil conditions and high groundwater. At this early stage of analysis, it was decided to assume a temporary shoofly is needed to accomplish the undercrossing, even if just for a pedestrian-scale structure.

- It was noted that this process is an important step to get ahead of the design and construction of the High Speed Rail project. The intent is for the City to have a proactive hand in how the existing crossings are impacted as well as creating a full access crossing that serves the community. Having a firm concept will benefit the City in competing for funding for the project. It is also important to emphasize that this plan is only a concept. Exact impacts are not established as part of these plans. The plans show the likely impacts, and there will be opportunities for geometric adjustments when final design occurs.

C. Open House Meeting Preparation

- Public open house meeting is scheduled for 4/11/12. Distributed copies of the mailer the City will be sending to local area residents to invite them to the meeting.

- The agenda for the public meeting will be to cover the purpose of the project, evaluation process, key issues, general recommendations resulting from the analyses and areas of impact.

- Meeting invites to include the area west of South Pacific Avenue. East of Pacific, the area is generally confined to the properties in the immediate vicinity of potential impacts from the layout options.

D. Next Steps

- Open House
- City Council Meeting
- Complete Study

Distribution:
All attendees; David Smelser (BNSF); Rosemary Siipola (CWCOG); Nancy Malone (Kelso); Adrian Esteban (DEA)

SOUTH KELSO RAILROAD CROSSING STUDY

OPEN HOUSE MEETING
WEDNESDAY, April 11th, 2012
6:00 PM

Kelso City Hall
City Council Chambers
203 South Pacific
Kelso, WA

The City of Kelso has undertaken a study funded by WSDOT rail to establish a new pedestrian and vehicular crossing at the BNSF Railroad along South Pacific Avenue in the vicinity of Hazel Street. This will enable the City to take a proactive role and mitigate potential future impacts to the local community associated with the Washington State High-Speed Rail (HSR) project. The options considered an under- or overcrossing at several locations along Pacific Avenue.

A new crossing will:

- Address impacts related to the proposed addition of a third track which would likely render at least one of the existing at grade crossings inoperable.
- Provide safe access to the land between the railroad line and the Cowlitz River for potential future development and recreational opportunities.
- Address safety issues with retention or elimination of other at-grade crossings.

The goal of the study is to provide a recommended alternative, and prepare preliminary plans and cost estimates for the preferred crossing alternative. The study does not include a detailed design at this time, and construction timing would be based on funding, as well as timing for the HSR project. An additional objective is to provide a concept that allows for delayed timing of final design and construction that will be compatible with the HSR project. It is intended that the study provide the basis and justification for securing the funding needed to complete design of construction of the project.

A brief presentation will take place starting at 6:00 p.m. followed by an opportunity for questions and comments. Drawings and exhibits will be on display.

If you have questions about the Open House, Study, or would like to provide comments, please contact Mike Kardas at the City of Kelso 360-577-3376 or mkardas@kelso.gov.

South Kelso Railroad Crossing Study

- Address Safety at Railroad Crossing Ahead of Washington High Speed Rail (HSR) Project
- Identify Key Issues, Needs, and Impacts for Access
- Determine Budget Needs for Future Funding
- Detailed Design and Construction Timing Based on Funding Availability

Next steps:

- Complete Current Study
- Identify and Pursue Funding
- Coordination by City with WSDOT and BNSF for HSR Project
- Final Design and Construction (timing based on funding availability)

DAVID EVANS AND ASSOCIATES INC.

DAVID EVANS AND ASSOCIATES INC.

Meeting Minutes

Open House #1 **April 11, 2012**
South Kelso Railroad Study

Attendees:
Mike Kardas, Nancy Malone – City of Kelso
Neal Christensen, Adrian Esteban, Tom Walsh – David Evans and Associates
See attached sign-in sheet for Open House Attendees

A. Introduction and Overview

Mike Kardas introduced the project team. He explained how the funding for this study was re-purposed from an earlier award for a pedestrian overcrossing of the tracks near City Hall. He emphasized the purpose of the consultant effort at this time was to establish the optimal location for a grade separated road and pedestrian crossing of the tracks, which would accommodate the future high-speed rail (HSR) project, and determine the cost impacts of the project. The City would use this information to pursue funding to design and build the project. The project is not funded for construction at this time. There is no established timeline for final design and construction.

Tom Walsh provided a presentation that described five scenarios for crossing the tracks. The primary locations focused on a crossing in the vicinity of Hawthorne and in the vicinity of Hazel. Both locations examined over- and under-crossings. He reviewed concept plans for each and the cost estimates:

- Option 1 – Hazel Street – Undercrossing $51,004,000
- Option 2A – Hazel Street – Overcrossing $23,617,000
- Option 2B – Hazel Street – Overcrossing (raise Pacific) $33,247,000
- Option 3 – Hawthorne Street – Undercrossing $55,542,000
- Option 4 – Hawthorne Street – Overcrossing $28,460,000

The presentation summarized the background and current work on the project:

- The current study is intended to build on a 2002 WSDOT study for the HSR focused on a segment of the existing rail corridor from the vicinity of Toteff Road to Kelso Station. That study considered the existing at-grade road crossings in South Kelso. Options included closing Mill and Yew Streets.
- This study, in addition to providing guidance for a proposed grade-separated crossing, is intended to allow the City and community to be proactive in addressing potential impacts to the existing roadways from the HSR project that is scheduled for completion in 2017. The grade separation project, however, is not part of HSR project. It is a separate project performed separately by the City.
- The study considered grade separated crossings at Hazel and Hawthorne. Both locations were examined for impacts from crossing over or under the existing tracks. Cost estimates include extending the east-west roadways to 13th Avenue and River Road.

- The costs of the undercrossings are driven by the need to build a temporary rail by-pass ("shoofly") for train traffic while the new bridge undercrossing was under construction.
- The overcrossing would be approximately 40 feet above grade to clear the tracks and allow for the overcrossing bridge beams.
- An evaluation was performed that considered safety, costs, property acquisitions, construction impacts, environmental constraints, land development opportunities and long-term maintenance.
- The project was also reviewed by a Stakeholder Group that included representatives from Kelso, Cowlitz County, BNSF, WSDOT, CWCOG and Chris Smith of the Three Rivers Golf Course. This group met four times during the development of the Options to discuss impacts and costs, and to provide the design team with key issues and feedback on the design.
- Option 2A scored the highest. The Hazel location already includes a connection to 13th and allows for more available land to build the new roadway on the west side of the crossing. The overcrossing has the lowest long-term maintenance needs and cost. An undercrossing would have to contend with high groundwater, affecting construction and would likely require pumps for stormwater runoff during and after rain storms, as well as needing to pump out groundwater. The DEA team is prepared to recommend Option 2A as the preferred alternative. The final decision on the configuration to be moved ahead for funding requests will be made by City Council.
- It was noted that the overcrossing has visual impacts that are less desirable than the undercrossing.
- Next steps include presenting the project at the Kelso City Council and completing the final study. Following the study completion, City staff will focus on pursuing funding, and working with WSDOT and BNSF to coordinate this study with the design of the HSR project.

B. Question and Answer

Following the presentation, the group fielded questions from the audience. The following Question and Answer summary has been edited for brevity.

Q. Which at-grade accesses will remain open?
A. Not determined yet. This study is to determine the most feasible location and configuration for a grade separated crossing. Under consideration for closure are the existing Mill and/or Yew Street at-grade crossings. The team met with the Fire and Police Departments. Both are in favor of the project, and the Fire Department expressed a preference to keep Mill open at least for emergency access.

Q. Will the tracks or road move into properties along South Pacific?
A. The undercrossing options require construction of a shoofly for the tracks that impact the golf course and other properties on the west side of the tracks for nearly a mile. There are five options and each has particular impacts to properties immediately adjacent to the crossing locations as shown on the plans.

Q. How high is the overcrossing? Is the existing Allen Street Bridge similar?
A. The overcrossing option would be approximately 40 feet above the existing street grade, probably similar to Allen Street. We need to be 23.5 feet above the existing track grade and the tracks are already about 10-12 feet above the existing street grade. Add the beam depth and deck thickness, and 40 feet is a good approximation of the height.

Q. How will this project be paid for?
A. The project is currently unfunded beyond this study. The project will be funded by public money, likely through a combination of local, regional, state and federal funding. It is not intended that an assessment district will be used to pay for the improvements.

Q. How steep are the approach grades to the overcrossing?
A. Within allowable grades by City design standards, approximately 7%. The grade may be similar to the approaches on the Allen Street Bridge, although that has not been checked or compared. The climb from existing grade to the top elevation of the bridge deck will occur over approximately 500 feet of horizontal distance.

Q. Have we factored in the flight pattern at the airport for clearance?
A. Yes. Street lighting will need to be limited in height for the overcrossing options, which means there will be more street lights with closer spacing. That has not been designed at this time.

Q. Is the City still looking at providing a pedestrian crossing or changing one of the existing roadway crossings to a pedestrian crossing?
A. The proposed options all include sidewalks and bike lanes. A separate reduced-size undercrossing was examined for pedestrians in the vicinity of Yew Street. Similar to the vehicular undercrossing options, this would require construction of a shoofly because of potential complications from poor soils or groundwater impacts. It is therefore prohibitively expensive as part of the grade separation project, but the City may continue to look at options for a pedestrian crossing as future funding possibilities are explored.

Q (from the business owner near the northeast corner of Hazel and South Pacific). My business depends on pass-by traffic turning from South Pacific onto Hazel. Closing the through street (where the existing grade runs into the approach grade to the overcrossing) will have a negative impact on my business due to the reduction in pass-by traffic. Will I be compensated for this potential loss?
A. No. Compensation is intended to occur for acquired property, relocations and easements directly impacted by the physical footprint of the project.

Q. When will the project be completed?
A. The project is in the planning stages, and there is currently no funding for design. It is hoped that funding can be obtained that would allow the project to be integrated with the overall schedule for the HSR project to be completed in 2017. An overcrossing option provides more flexibility in schedule because there will be no impact to train operations.

Q. What is the impact from a third track on the properties?
A. That is part of the High Speed Rail (HSR) project. We can only generally describe the HSR project here as it is not part of this project. Rosemary Siipola gave a general description of the HSR project. Rosemary explained that the project runs from the vicinity of Toteff Road (Exit 27) to the Kelso Station. Improvements will also occur at the rail yard. The project is primarily to enhance capacity and will not significantly increased speeds. There will be a third track primarily along the west side of the existing double track. In some locations, it will be on the east side. The goal is to complete that project in 2017.

Q. I thought the HSR project needed to be done by 2015?
A. The HSR project is scheduled for completion in 2017.

C. Synopsis/Next Steps

Based on individual conversations, it appeared there was a general preference for the Hazel overcrossing. However, there was a strong concern expressed by an individual property owner at the northeast corner that, by converting the remnant portion of Hazel to a dead-end street, he will lose business that comes from existing drive-by traffic turning onto Hazel from South Pacific.

Next steps include presenting the project to City Council and completion of the study by the DEA team. City staff may also consider making the presentation available to the Cowlitz County Commissioners and CWCOG TAC.

Attachments:

- PowerPoint Presentation
- Sign-in Sheet
- Open House Handout

Distribution:

- Mike Kardas, Nancy Malone
- S. Kelso Railroad Study Stakeholder Group
- DEA attendees

Appendix I

Selection Criteria

Evaluation of Options: Scoring Results

S. Kelso Railroad Study
Kelso, Washington
Alternatives Evaluation Selection Criteria Descriptions

Note: High weight = High project priority

Criteria	*Description*	*Rank (most important =1)*	*Weight (1-10)*
Neighborhood Safety	*Relative safety based on increased traffic to residential areas, and safest environment for non-motorized users. Scoring: Award 5 for best; 1 for worst*	*1*	*10*
Construction Cost	*Which alternative costs the least? Scoring: Award 5 for lowest; 1 for highest*	*2*	*9*
Complete Acquisitions – Business and Residential	*Which alternative requires the least number of complete acquisitions of lots/buildings? Scoring: Award 5 for least impact; 1 for most impact*	*3*	*7*
Constructability	*Which has the lowest risk for potentially significant impacts to safety, cost, or construction feasibility during construction? Award 5 for least and 1 for highest*	*3*	*7*
Environmental Impact	*Which alternative has the least impact from an environmental documentation process? Includes natural resource, visual, and socio/economic issues. Award 5 for lowest; 1 for highest*	*5*	*5*
Redevelopment Opportunity	*Which alternative creates opportunities for future redevelopment of either remnant parcels of land remaining, or on existing land adjacent to the realignment? Scoring: Award 5 for most opportunity; 1 for least*	*6*	*4*
Long Term Maintenance	*Which alternative commits the City to the highest long term maintenance cost? Scoring: Award 5 for best; 1 for worst*	*6*	*4*
Partial Property Acquisitions – Residential and Commercial	*Which alternative has the least overall need to acquire land from existing properties? Scoring: Award 5 for least impact; 1 for most impact*	*8*	*3*

S. Kelso Railroad Study

Kelso, Washington

Alternatives Evaluation - Selection Worksheet

		Hazel Crossing Location			*Hawthorne Crossing Location*		
Evaluation Categories	***Weight (1-10)***	**Option 1-Under**	**Option 2A-Over**	**Option 2B-Over (Raise Pacific)**	**Option 3-Under**	**Option 4-Over**	***Notes***
Neighborhood Safety	***10***	5	4	2	3	2	3 & 4 has a new connection to 13th with more traffic through neighborhood; higher residential density near Hawthorne
Construction Cost	***9***	1	5	2	1	2	Shoofly and construction in groundwater increases costs
Complete Acquisitions (Least)	***7***	5	4	3	1	1	
Constructability	***7***	2	5	3	1	4	Risk of groundwater issues during construction and long term management
Environmental Impact	***5***	5	4	3	1	1	Connection to 13th with 3 & 4 include additional crossing of wet areas; assumes that an undercrossing has less visual impact to those residing closest to the crossing
Long Term Maintenance	***4***	2	5	3	1	3	Undercrossings include stormwater pumps and potential complications from groundwater
Redevelopment Opportunity	***4***	5	4	1	3	2	
Property Acquisition (Least)	***3***	5	3	2	3	3	
Total		176	213	117	83	107	

See Alternatives Evaluation Criteria Description for definitions of scoring criteria (5=Most Favorable; 1=Least Favorable)

Appendix J

Hazardous Material Database Review

Hazardous Material Database Review

The consultant team accessed existing databases on the Washington Department of Ecology website for reported sites of hazardous materials. Relevant hazmat site databases were searched for sites within a quarter mile of the project area. The searches revealed 15 underground storage tanks, shown in the table below. A map of the sites was included in the body of the report. Only one storage tank is within the larger project area.

Regulated Underground Storage Tank Status

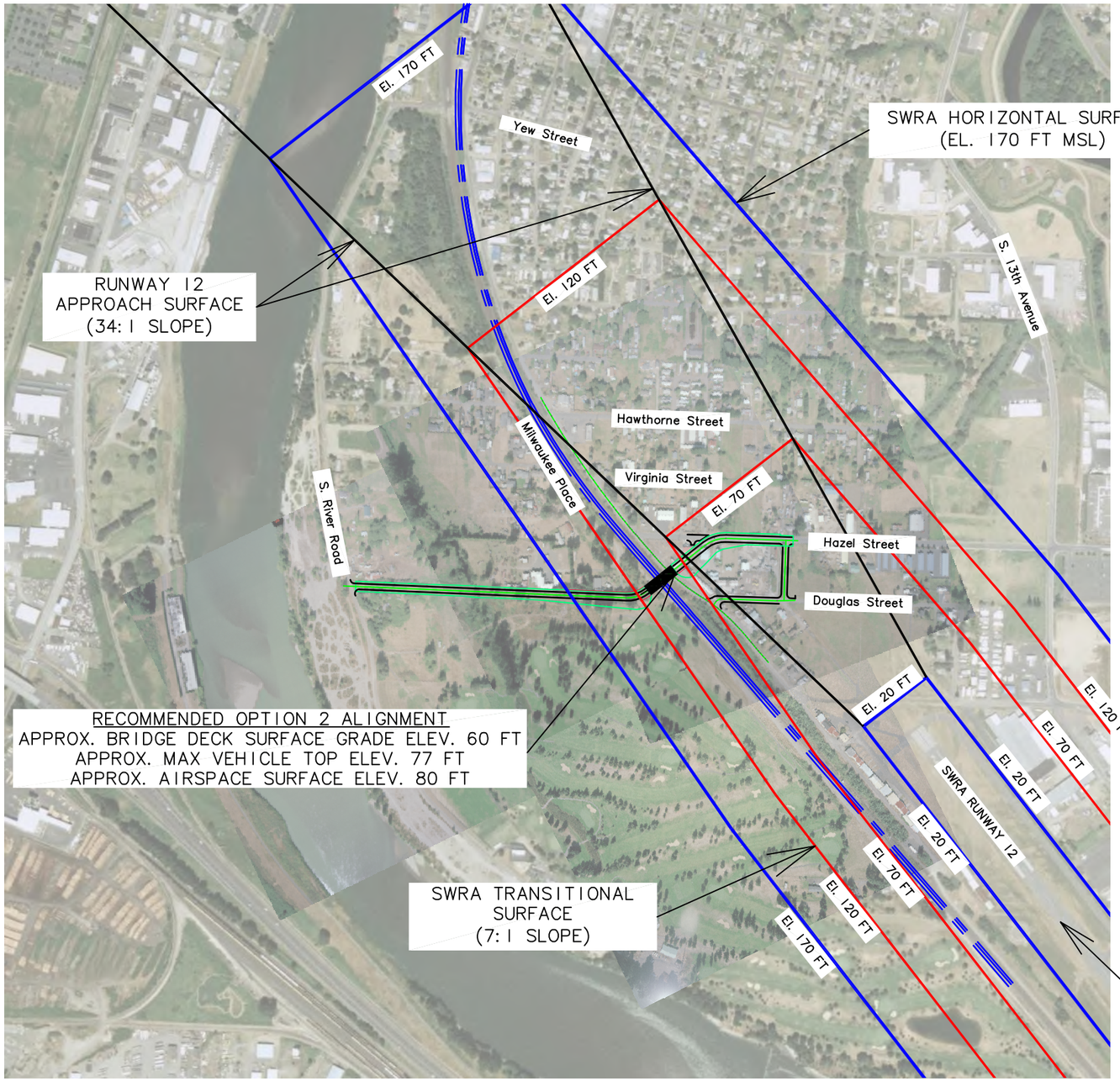
UST ID	Site_Name	Address	Tank Status	Install Date	Substance
9036	A L PRICE INC	1710 S PACIFIC	Removed	1964	Diesel
9036	A L PRICE INC	1710 S PACIFIC	Removed	1964	Diesel
9036	A L PRICE INC	1710 S PACIFIC	Removed	1964	Used Oil/Waste Oil
9036	A L PRICE INC	1710 S PACIFIC	Closed in Place	1964	Unknown
1000	AERO WEST	2222 S PACIFIC	Removed	1964	Unleaded Gasoline
1000	AERO WEST	2222 S PACIFIC	Removed	1964	Unleaded Gasoline
1000	AERO WEST	2222 S PACIFIC	Removed	1964	
102502	KELSO ONE STOP	1800 S PACIFIC AVE	Operational	1981	Unleaded Gasoline
102502	KELSO ONE STOP	1800 S PACIFIC AVE	Operational	1981	Unleaded Gasoline
102502	KELSO ONE STOP	1800 S PACIFIC AVE	Operational	1981	Unleaded Gasoline
3799	P & H LOGGING CO INC DENNIS PAGE	244 MILWAUKEE PL	Closed in Place	1964	Leaded Gasoline
3799	P & H LOGGING CO INC DENNIS PAGE	244 MILWAUKEE PL	Closed in Place	1964	Leaded Gasoline
3799	P & H LOGGING CO INC DENNIS PAGE	244 MILWAUKEE PL	Closed in Place	1964	
102480	THREE RIVERS GOLF COURSE	2222 S RIVER RD	Removed	1980	Leaded Gasoline
102480	THREE RIVERS GOLF COURSE	2222 S RIVER RD	Removed	1980	Leaded Gasoline
24	TOLLYCRAFT CORPORATION	2200 CLINTON AVE	Removed	1964	Hazardous Substance

Appendix K

Flight Path Diagram

400' 200' 0 400' 800'

SCALE: 1" = 400'



NOTES:

– FLIGHT PATH INFORMATION AND ELEVATIONS TAKEN FROM "SOUTHWEST WASHINGTON REGIONAL AIRPORT MASTER PLAN" BY URS, DATED FEBRUARY 2011.

– FINAL GRADES AND CLEARANCES TO BE VERIFIED BY ACTUAL FIELD SURVEY DURING FINAL DESIGN.

S KELSO RR CROSSING STUDY

FLIGHT PATH DIAGRAM

DAVID EVANS AND ASSOCIATES INC.
2100 Southwest River Parkway
Portland, Oregon 97201
Phone: 503.223.6663

REVISIONS: APPD.

DATE:
DESIGN: ACE
DRAWN: JABE
CHECKED:
REVISION NUMBER:

SCALE: AS SHOWN

PROJECT NUMBER:
KES000000002

DRAWING FILE:
kess0002_vicinitymap_sht_color.dwg

SHEET NO.
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SHEET OF

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